

CHAPTER 7

SMALL BUSINESS ANALYSIS

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 et seq., Public Law 96-354) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) (Public Law 104-121) requires agencies to analyze how a regulation will affect small entities. The purpose of the RFA is to establish as a principle of regulation that agencies should tailor regulatory and informational requirements to the size of entities, consistent with the objectives of a particular regulation and applicable statutes. If, based on an initial assessment, a regulation is likely to have a significant economic impact on a substantial number of small entities, the RFA requires a regulatory flexibility analysis. The requirement to prepare a regulatory flexibility analysis does not apply if the head of the agency certifies that the promulgated rule will not have a significant impact on a substantial number of small entities.

EPA performed an initial assessment and a small business analysis of impacts. The first steps in an initial assessment are presented in Section 7.1. Section 7.2 describes the methodology for the small business analysis and Section 7.3 presents the results of the analysis.

7.1 INITIAL ASSESSMENT

EPA guidance on implementing RFA requirements suggests four issues should be addressed in an initial assessment—notice-and-comment requirements, profile of affected small entities, an evaluation of whether the rule would affect small entities, and a determination whether the rule would have a significant impact a substantial number of small entities (U.S. EPA, 1999). First, EPA determined that effluent limitations guidelines and standards regulations were subject to notice-and-comment rulemaking requirements and met those requirements. Second, EPA developed a profile of the affected universe of entities—both large and small—in Chapter 2. Section 7.2 describes the data and procedures that EPA used to identify the number of small entities and estimate the number of sites owned by small entities. Third, EPA determined that the rule would affect small entities. Fourth, EPA determined whether the rule

would have a significant economic impact on a substantial number of small entities. Chapter 4 presents the economic methodology while Section 7.3 summarizes the findings for small entities.

7.2 SMALL BUSINESS IDENTIFICATION

7.2.1 Classification

The Small Business Administration (SBA) sets size standards to define whether a business entity is small and publishes these standards in 13 CFR 121. The standards are based either on the number of employees or receipts. Prior to October 1, 2000, SBA set size standards according to the Standard Industrial Classification (SIC) system. Accordingly, the EPA survey requested the respondents to identify different levels in a site's corporate hierarchy by SIC code. The rule, however, was proposed after October 1, 2000, when SBA set size standards according to the North American Industry Classification System (NAICS; FR, 1999). EPA examined both classification systems when identifying sites owned by small entities. The remaining subsections walk the reader through the methodology steps to identify small entities in the iron and steel industry.

7.2.1.1 SBA Guidance

When making classification determinations, SBA counts receipts or employees of the entity and all of its domestic and foreign affiliates (13 CFR.121.103(a)(4)). SBA considers affiliations to include:

- # stock ownership or control of 50 percent or more of the voting stock or a block of stock that affords control because it is large compared to other outstanding blocks of stock (13 CFR 121.103(c)).
- # common management (13 CFR 121.103(e)).
- # joint ventures (13 CFR 121.103(f)).

EPA interprets this information as follows:

- # Sites with foreign ownership are not small (regardless of the number of employees or receipts at the domestic site).
- # The definition of small is set at the highest level in the corporate hierarchy and includes all employees or receipts from all members of that hierarchy.
- # If any one of a joint venture's affiliates is large, the venture cannot be classified as small. EPA determined ownership from survey responses and determined affiliates not specified in the survey from secondary sources. Corporate ownership of sites in the iron and steel database is based on January 2000.

7.2.1.2 Data Used for Business Size Classification

EPA requested the respondent to identify the SIC code for the site, business entity that owns the site, and the corporate parent that owned the business entity (or for as many levels in the corporate hierarchy that exist). Determining the level in the corporate hierarchy at which to define whether a business entity is a small business is site-by-site assessment because, in some cases, the respondent entered the number of employees literally at the corporate headquarters and not for the entire company. The guidelines used to determine the level in the corporate hierarchy by which to classify the site is summarized here:

- # If a corporate parent exists,
 - If it is foreign, classify the site as such and remove from further analysis.
 - If the parent's classification depends on the number of employees and the number for the parent exceeds that for the company, use the parent's data for classification.
 - If the parent's classification depends on revenues, use the parent's data for classification.
 - If none of the above applies to the site, use the company information for classification.
- # If a site is a joint entity,
 - If any of the joint owners is a large business, classify the site as such and remove from further analysis.
 - If any of the joint entity partners are foreign, remove from further consideration.

- # At the company level,
 - If it is foreign, classify as such and remove from further consideration.
 - If a company's classification depends on the number of employees and the number of employees is the same as or exceeds that for the site, use the company's data for classification.
 - If a company's classification is determined by revenues, use the company's data for classification.

- # If the site is the company, no other levels in the hierarchy exist, the site data are used for classification.

7.2.1.3 SIC Codes Reported in EPA Survey

Table 7-1 is a summary of the 28 4-digit SIC codes in EPA Survey data listed for the level at which the size classification is made. Although the sampling frame for the EPA Survey focused on four SIC codes: 3312, 3315, 3316, and 3317, the SIC codes extend beyond iron and steel operations because corporate parents hold operations in other sectors.

Several sites appear to be classified at the industry group level (3-digit code) and one site is classified at the major group level (2-digit code). Entries with a final zero are presumed to be classified at the 3-digit level (e.g., 1520, 2870, 3310, 3370, 3440, 3470, and 3490) and an entry with a final double zero is assumed to be classified at the 2-digit level (i.e., 3300).

Several of the 4-digit SIC codes provided by the respondents, however, do not exist in the 1987 SIC classification Manual (i.e., 1516, 2998, and 6749). For these sites, EPA classified the site at the 2- or 3- digit level. Table 7-1 lists the standards for each SIC code used in the small business analysis.

7.2.1.4 Updated Site Ownership Information

EPA searched secondary data to verify corporate ownership for each site and updated ownership to January 2000. The supporting material is in the rulemaking record.

Table 7-1
SIC Codes in Iron and Steel Database

SIC		Size		Detailed		
Code	Short Name	Standard*	Short	Parent	Company	Site
1221	Bituminous Coal and Lignite Surface Mining	500			x	
1516	15: Building Construction-General Contractors and Operative Builders	\$17				x
1520	152: General Building Contractors-Residential Buildings	\$17		x		
2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments	750			x	
2911	Petroleum Refining	1,500		x		
2998	299: Miscellaneous Products of Petroleum and Coal	500				x
3300	33: Primary Metal Industries	500	x			
3310	331: Steel Works, Blast Furnaces, and Rolling and Finishing Mills	1,000		x	x	
3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	1,000	x	x	x	x
3315	Steel Wiredrawing and Steel Nails and Spikes	1,000			x	
3316	Cold-Rolled Steel Sheet, Strip, and Bars	1,000	x	x	x	
3317	Steel Pipe and Tubes	1,000	x	x	x	
3321	Gray and Ductile Iron Foundries	500			x	
3351	Rolling, Drawing, and Extruding of Copper	750	x			
3356	Rolling, Drawing, and Extruding of Nonferrous Metals, Except Copper and Aluminum	750			x	
3370	33: Primary Metal Industries	500			x	
3440	344: Fabricated Structural Metal Products	500		x		
3470	347: Coating, Engraving, and Allied Services	500	x			
3471	Electroplating, Plating, Polishing, Anodizing, and Coloring	500	x		x	
3479	349: Coating, Engraving, and Allied Services, NEC	500	x			
3490	Miscellaneous Fabricated Metal Products	500	x			
3562	Ball and Roller Bearings	750			x	
3674	Semiconductors and Related Devices	500		x		
4925	Mixed, Manufactured, or Liquefied Petroleum	\$5			x	
5051	Metals Service Centers and Offices	100	x		x	
5093	Scrap and Waste Materials	100			x	
5153	Grain and Field Beans	100		x		
6749	67: Holding and Other Investment Offices	\$5		x		
Totals			10	10	15	3

Notes: Standards are either the number of employees or millions of dollars in revenue. If 4-digit SIC code is not listed in Standard Industrial Classification Manual, 1987, size standard is taken from the 3-digit or 2-digit level. For SIC 3310, a size standard of 1,000 employees is used because all steel-related codes in the 331 industry group have a size standard of 1,000 employees is used. SIC 3313 has a different size standard but it excludes steel.

7.2.1.5 NAICS Standard

The North American Industry Classification System (NAICS) replaces the Standard Industrial Classification (SIC) as of January 1, 1997. The Small Business Administration converted business size standards to NAICS effective October 1, 2000 (FR, 2000). Appendix B cross-references the SIC codes with the NAICS codes and size standards.

Table 7-2 is a subset of Appendix B, listing only those SIC codes that change size standards when considered under NAICS. The following industries are potentially affected by the shift:

- # SIC 4925 is part of NAICS 22121. The size standard changes from \$5 million to 500 employees.
- # Stand-alone coke ovens, formerly part of SIC 3312 (steel works, blast furnaces, and rolling mills), are now classified in NAICS 324199. The size standard replaces 1,000 employees with 500 employees.
- # SIC 2865 is divided between NAICS 32511 and 325132. If the company shifts to the first NAICS category, the size standard changes from 750 to 1,000 employees.
- # SIC 3399, with a size standard of 750 employees- is split among four NAICS categories: 331111, 331492, 332618, and 332813. Only the first and last categories concern steel. If the company shifts to NAICS 331111, the size standard becomes 1,000 employees. If the company shifts to NAICS 332813, the size standard becomes 500 employees.
- # SIC 3315 is split between NAICS 33122 and 332618. If the company shifts to the second NAICS category, the size standard changes from 1,000 to 500 employees.
- # SIC 3699- with a size standard of 750 employees- is split among NAICS categories 333319 and 333618. If the company shifts to the first category, the size standard becomes 500 employees. If the company shifts to the second category, the size standard becomes 1,000 employees.

EPA examines each site whose company's status could change as a result of the shift from SIC to NAICS. No site changed classifications with the shift from SIC to NAICS.

Table 7-2
Cross-reference Between NAICS and SIC Codes
Size Standard Changes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Size standard (\$ million or emp #) for NAICS industry	Size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
Sector 22 -- Utilities						
Subsector 221 -- Utilities						
22121	Natural Gas Distribution	R	500	\$5.0	*4923	Natural Gas Transmission and Distribution (distribution)
				500	4924	Natural Gas Distribution
				\$5.0	4925	Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Distribution (natural gas distribution)
				\$5.0	*4931	Electronic and Other Services Combined (natural gas distribution)
				\$5.0	4932	Gas and Other Services combined (natural gas distribution)
				\$5.0	*4939	Combination Utilities, NEC (natural gas distribution)
Subsector 324 -- Petroleum and Coal Products Manufacturing						
324199	All Other Petroleum and Coal Products Manufacturing	R	500	500	2999	Products of Petroleum and Coal, NEC

Table 7-2 (continued)

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Size standard (\$ million or emp #) for NAICS industry	Size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
				1,000	*3312	Blast Furnaces and Steel Mills (coke ovens)
Subsector 325 -- Chemical Manufacturing						
32511	Petrochemical Manufacturing	N	1,000	750	*2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (aromatics)
				1,000	*2869	Industrial Organic Chemicals, NEC (aliphatics)
325132	Synthetic Organic Dye and Pigment Manufacturing	N	750	750	*2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (organic dyes and pigments)
Subsector 331 -- Primary Metal Manufacturing						
331111	Iron and Steel Mills	N	1,000	1,000	*3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills (except coke ovens not integrated with steel mills)
				750	*3399	Primary Metal Products, NEC (ferrous powder, paste, flakes, etc.)
331222	Steel Wire Drawing	R	1,000	1,000	*3315	Steel Wiredrawing and Steel Nails and Spikes (steel wire drawing)

Table 7-2 (continued)

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Size standard (\$ million or emp #) for NAICS industry	Size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
331492	Secondary Smelting, Refining, and Allying of Nonferrous Metal (except Copper and Aluminum)	N	750	750	*3313	Electrometallurgical Products, Except Steel (except Copper and Aluminum)
				500	*3341	Secondary Smelting and Reining of Nonferrous Metals (except Copper and Aluminum)
				750	*3399	Primary Metal Products, NEC (except Copper and Aluminum)
Subsector 332 - Fabricated Metal Product Manufacturing						
				500	*3499	Fabricated Metal Products, NEC (safe and vault locks)
332618	Other Fabricated Wire Product Manufacturing	R	500	1,000	*3315	Steel Wiredrawing and Steel Nails and Spikes (nails, spikes, paper clips and wire not made in wiredrawing plants)
				750	*3399	Primary Metal Products, NEC (nonferrous nails, brads, staples, etc.)
				500	3496	Miscellaneous Fabricated Wire Products
332813	Electroplating, Plating, Polishing, Anodizing and Coloring	R	500	750	*3399	Primary Metal Products, NEC (laminating steel)

Table 7-2 (continued)

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Size standard (\$ million or emp #) for NAICS industry	Size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
				500	3471	Electroplating, Plating, Polishing, Anodizing, and Coloring
Subsector 333 -- Machinery Manufacturing						
333319	Other Commercial and Service Industry Machinery Manufacturing	R	500	500	*3559	Special Industry Machinery, NEC (automotive maintenance equipment)
				500	3589	Service Industry Machinery, NEC
				500	*3599	Industrial and Commercial Machinery and Equipment, NEC (carnival amusement park equipment)
				750	*3699	Electrical Machinery, Equipment and Supplies, NEC (electronic teaching machines and flight simulators)
333618	Other Engine Equipment Manufacturing	R	1,000	1,000	*3519	Internal Combustion Engines, NEC (except stationary engine radiators)
				750	*3699	Electrical Machinery, Equipment and Supplies, NEC (outboard electric motors)

Source: Federal Register, 5 September 2000

7.2.2 Number of Small Entities

EPA evaluates the number of small entities as the number of sites belonging to small businesses. EPA conducted a survey, not a census, of the iron and steel industry. That is, the Agency sent questionnaires to some but not all sites in the iron and steel industry. Because EPA drew the sample on the basis of site characteristics, the Agency could develop statistical weights for sites but not for companies.

EPA identified 115 companies in the survey of which 35 are small. Based on the statistical weights for the sites owned by these companies, EPA estimates that approximately 61 sites nationwide are owned by small entities. Because the number of companies cannot exceed the number of sites, the approach is conservative.

7.3 IMPACTS FROM PROMULGATED RULE ON SITES OWNED BY SMALL ENTITIES

The Agency evaluated the annualized compliance cost for the final rule as a percentage of 1997 revenue. No small entity incurs costs in excess of one percent of revenues.

EPA projects no site closures from subcategory costs or combined subcategory costs; hence, there are no impacts on small entities. No business is projected to move into financial distress; hence, no small entities are adversely affected.

7.4 REFERENCES

U.S. EPA. 1999. U.S. Environmental Protection Agency. *Revised Interim Guidance for EPA Rulewriters: Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act*. Washington, DC. 29 March.

FR. 2000. Small Business Administration. 13 CFR Part 121. Small business size regulations; size standards and the North American Industry Classification System. Correction. *Federal Register* 65:53533-53558. 5 September.

FR. 1999. Small Business Administration. 13 CFR Part 121. Small business size regulations; size standards and the North American Industry Classification System. Proposed Rule. *Federal Register* 64:57188-57286. 22 October 1999.

CHAPTER 8

ENVIRONMENTAL BENEFITS

8.1 OVERVIEW

An environmental assessment quantifies the water quality-related benefits associated with achievement of the Best Available Technology (BAT) and Pretreatment Standards for Existing Sources (PSES) promulgated by the U.S. Environmental Protection Agency (EPA) to regulate iron and steel facilities (U.S. EPA, 2002, summarized here). This environmental assessment bases its conclusion of the water quality-related benefits on aggregate site-specific analyses of current conditions and of changes expected to result from compliance with the final iron and steel effluent guidelines and standards for Best Available Technology Economically Achievable (BAT) and Pretreatment Standards for Existing Sources (PSES). The final regulations limit the discharges of pollutants into navigable waters of the United States and the introduction of pollutants into POTWs from existing sources and from new sources in two iron and steel subcategories. These categories are cokemaking and sintering. Only loadings from the two subcategories are aggregated to estimate the combined environmental effects of the final rule.

Using site-specific analyses of current conditions and changes in discharges associated with the promulgated regulation, EPA estimated in-stream pollutant concentrations for 50 priority and nonconventional pollutants using stream dilution modeling. EPA assessed the potential impacts and benefits to aquatic life by comparing the modeled in-stream pollutant concentrations to published EPA aquatic life criteria guidance or to toxic effect levels (Section 8.2). EPA projected human health benefits by (1) comparing estimated in-stream pollutant concentrations to health-based water quality toxic effect levels or criteria, and (2) estimating the potential reductions of carcinogenic risk and noncarcinogenic hazard (systemic) from consuming contaminated fish or drinking water (Section 8.3).

The assessment also evaluated potential inhibition of operations (i.e., inhibition of microbial degradation processes) at publicly owned treatment works (POTWs), and sewage sludge contamination (here defined as a sludge pollutant concentration in excess of that permitting land application or surface disposal of sewage sludge), at current and final pretreatment levels (Section 8.4). In addition, this report

presents the potential fate and toxicity of pollutants of concern associated with iron and steel wastewater on the basis of known characteristics of each chemical (Section 8.5). Section 8.6 provides a summary of the findings.

8.2 COMPARISON OF IN-STREAM CONCENTRATIONS WITH AMBIENT WATER QUALITY CRITERIA (AWQC) AND IMPACTS AT POTWS

8.2.1 Methodology

EPA employed stream dilution modeling techniques to assess the potential impacts and benefits of the final effluent guidelines and standards. Using site-specific analyses, EPA estimated in-stream pollutant concentrations for 50 priority and nonconventional pollutants¹ under current (baseline) and final treatment levels. EPA analyzed the effects on water quality from direct and indirect discharge operations separately. EPA had sufficient data to analyze water quality impacts for 22 of 25 of the iron and steel facilities being evaluated. EPA combined the impacts for the cokemaking and sintering subcategories to estimate water quality effects as a result of the final rule.

8.2.2 Findings

EPA compared modeled in-stream pollutant concentrations to ambient water quality criteria (AWQC)² or to toxic effect levels before and after the regulation. EPA estimates that current discharge loadings contribute to in-stream concentrations in excess of AWQC in 82 cases at 15 receiving streams.

¹ Evaluations do not include the impacts of 3 conventional and 7 nonconventional pollutants when modeling the effects of the final rule on receiving stream water quality and POTW operations or when evaluating the potential fate and toxicity of discharged pollutants. The discharge of these pollutants may adversely affect human health and the environment.

² In performing this analysis, EPA used guidance documents published by EPA that recommend numeric human health and aquatic life water quality criteria for numerous pollutants. States often consult these guidance documents when adopting water quality criteria as part of their water quality standards. However, because those State-adopted criteria may vary, EPA used the nationwide criteria guidance as the most representative values.

The final rule is expected to reduce the number of in-stream concentrations exceeding AWQC to 72 at 14 receiving streams, allowing one stream to obtain “contaminant-free” status.

EPA estimates that, under current (baseline) conditions, the 22 iron and steel facilities discharge approximately 4.4 million pounds per year (lb/year) of priority and nonconventional pollutants. The final rule is expected to reduce this pollutant loading by 22 percent to 3.4 million lb/year.

EPA assessed improvements in aquatic habitats using its findings of reduced occurrence of in-stream pollutant concentrations in excess of both aquatic life and human health criteria or toxic effect levels. EPA expects that these improvements in aquatic habitats will improve the quality and value of recreational fishing opportunities and nonuse (intrinsic) values of the receiving streams. EPA monetizes the attainment of the contaminant-free status based on improvements in recreational fishing opportunities and on the nonuse (intrinsic) value of the streams. The estimated monetized benefit of this improvement ranges from \$0.11 million to \$0.40 million (1997 dollars).

8.3 HUMAN HEALTH RISKS AND BENEFITS

8.3.1 Methodology

EPA projected human health benefits by (1) comparing estimated in-stream pollutant concentrations to health-based toxic effect values or criteria derived using standard EPA methodology, and (2) estimating the potential reductions of carcinogenic risk and noncarcinogenic hazard (systemic) from consuming contaminated fish and drinking water. The assessment estimated upper-bound individual cancer risks, population risks, and systemic hazards using modeled in-stream pollutant concentrations and standard EPA assumptions. The assessment evaluated modeled pollutant concentrations in fish and drinking water to estimate cancer risk and systemic hazards among the general population (drinking water only), sport anglers and their families, and subsistence anglers and their families.

8.3.2 Findings

EPA estimates that carcinogens in the current discharge loadings from the 22 iron and steel facilities could be responsible for 0.9 total excess annual cancer cases from the consumption of contaminated fish. The final rule is expected to reduce the carcinogenic loadings and the estimated excess annual cancer cases to 0.4. The estimated monetized benefit of these reductions in human health effects ranges from \$1.2 million to \$6.3 million (1997 dollars). In addition, EPA projects that the final rule will not eliminate the hazard to approximately 5,000 people potentially exposed to systemic toxicant effects from consumption of contaminated fish. EPA, therefore, projects no potential economic benefits from reduced systemic effects.

8.4 ECONOMIC PRODUCTIVITY BENEFITS

The environmental assessment also evaluated the potential inhibition of POTW operations and potential contamination of sewage biosolids (which limits its use for land application) based on current and final pretreatment levels. EPA estimated inhibition of POTW operations by comparing modeled POTW influent concentrations to available inhibition levels. EPA assessed the potential contamination of sewage biosolids by comparing projected pollutant concentrations in sewage biosolids to available EPA regulatory standards for land application and surface disposal of sewage biosolids.

EPA estimates that none of the seven publicly owned treatment works (POTWs) considered in this assessment are experiencing inhibition problems or impaired biosolid quality due to iron and steel wastewater discharges. EPA, therefore, projects no potential economic benefits from reduced biosolid disposal costs.

8.5 POLLUTANT FATE AND TOXICITY

EPA identified a total of 60 pollutants of concern (22 priority pollutants, three conventional pollutants, and 35 nonconventional pollutants) at treatable levels in waste streams from the 22 iron and

steel facilities. EPA evaluated 50 of these pollutants with sufficient data to assess their potential fate and toxicity on the basis of known physical-chemical properties, and aquatic life and human health toxicity data.

Most of the 50 pollutants have at least one known toxic effect. EPA determined that 20 exhibit moderate to high toxicity to aquatic life, 19 are classified as known or probable human carcinogens, 36 are human systemic toxicants, 16 have drinking water values, and 22 are designated as priority pollutants. In terms of projected partitioning among media, 17 of the evaluated pollutants are moderately to highly volatile (potentially causing risk to exposed populations via inhalation), 25 have a moderate to high potential to bioaccumulate in aquatic biota (potentially accumulating in the food chain and causing increased risk to higher trophic level organisms and to exposed human populations via consumption of fish and shellfish), 20 are moderately to highly adsorptive to solids, and seven are resistant to biodegradation or are slowly biodegraded.

8.6 SUMMARY OF POTENTIAL EFFECTS/BENEFITS FROM FINAL EFFLUENT GUIDELINES

EPA estimates that the annual monetized benefits resulting from the effluent guidelines will range from \$1.3 million to \$6.7 million (1997 dollars). Table 8-1 summarizes these effects/benefits. The range reflects the uncertainty in evaluating the effects of this rule and in placing a monetary value on these effects. The reported benefit estimate understates the total benefits expected to result under this rule. Additional benefits, which cannot be quantified in this assessment include improved ecological conditions from improvements in water quality, improvements to other recreational activities, and reduced discharge of conventional and other pollutants.

8.7 REFERENCE

U.S. EPA. 2002. Environmental Assessment of the Final Effluent Limitations Guidelines and Standards for the Iron and Steel Industry. U.S. Environmental Protection Agency. Washington, DC. EPA-821-R-02-005.

Table 8-1

**Summary of Potential Effects/Benefits from the
Final Effluent Guidelines for the Iron and Steel Industry^a**

	Current	Final Rule	Summary of Benefits
Loadings (million lb/yr) ^{b, c}	4.4	3.4	22 percent reduction
Number of Instream Excursions for Pollutants That Exceed AWQC	82 at 15 streams	72 at 14 streams	one stream becomes “contaminant-free” ^d Monetized benefits (recreational/nonuse) = \$0.11 to \$0.40 million
Excess Annual Cancer Cases ^e	0.9	0.4	Reduction of 0.5 case each year Monetized benefits = \$1.2 to \$6.3 million
Population Potentially Exposed to Other Noncarcinogenic Health Risks ^e	5,000	5,000	Health effects to exposed population not eliminated
POTWs Experiencing Inhibition	none of 7	none of 7	No baseline impacts
Improved POTW Biosolid Quality	0 metric tons	0 metric tons	No baseline impacts
Total Monetized Benefits			\$1.3 to \$6.7 million (1997 dollars)

- a. Modeled results from 15 direct and 8 indirect facilities.
- b. Loadings are representative of 50 priority and nonconventional pollutants evaluated; 3 conventional pollutants and 7 nonconventional pollutants are not included.
- c. Loadings do not account for POTW removals.
- d. “Contaminant-free” from iron and steel discharges; however, potential contamination from other point source discharges and nonpoint sources is still possible.
- e. Through consumption of contaminated fish.

CHAPTER 9

COST-BENEFIT COMPARISON AND UNFUNDED MANDATES REFORM ACT ANALYSIS

9.1 COST-BENEFIT COMPARISON

The pre-tax annualized cost is \$11 million in 1997 dollars for the final rule (see Table 5-6). The pre-tax cost is a proxy for the social cost of the regulation because it incorporates the cost to industry (post-tax costs), and costs to State and Federal governments (i.e., lost income from tax shields).¹ In other words, the cost part of the equation is well-identified and estimated.

The estimated quantified and monetized benefits of the rule range from \$1.3 million to \$6.7 million (see Table 8-1). This, however, is an underestimate because EPA can fully characterize only a limited set of benefits to the point of monetization. Chapter 8 focuses mainly on identified compounds with quantifiable toxic or carcinogenic effects. This potentially leads to an underestimation of benefits, since some significant pollutant characterizations are not considered. For example, the analyses do not include the benefits associated with reducing the particulate load (measured as TSS), or the oxygen demand (measured as BOD₅ and COD) of the effluents. TSS loads can degrade an ecological habitat by reducing light penetration and primary productivity, and from accumulation of solid particles that alter benthic spawning grounds and feeding habitats. BOD₅ and COD loads can deplete oxygen levels, which can produce mortality or other adverse effects in fish, as well as reduce biological diversity. Therefore, the reported benefit estimate understates the total benefits of this rule.

9.2 UNFUNDED MANDATES REFORM ACT ANALYSIS

Title II of the Unfunded Mandates Reform Act of 1995 (Public Law 104-4; UMRA) establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal

¹All sites are currently permitted and permits are reissued on a periodic basis, so incremental costs administrative costs of the regulation are negligible.

governments as well as the private sector. Under Section 202(a)(1) of UMRA, EPA must generally prepare a written statement, including a cost-benefit analysis, for proposed and final regulations that “includes any Federal mandate that may result in the expenditure by State, local, and tribal governments, in the aggregate or by the private sector” of annual costs in excess of \$100 million.² As a general matter, a federal mandate includes Federal Regulations that impose enforceable duties on State, local, and tribal governments, or on the private sector (Katzen, 1995). Significant regulatory actions require Office of Management and Budget review and the preparation of a Regulatory Impact Assessment that compares the costs and benefits of the action.

The final iron and steel industry effluent limitations guidelines are not an unfunded mandate on state, local, or tribal governments because industry bears the cost of the regulation. The cost estimate to industry does not exceed \$100 million/year; hence, the rule is not an unfunded mandate on industry. EPA, however, is responsive to all required provisions of UMRA. In particular, the Economic Analysis (EA) addresses:

- # Section 202(a)(1)—authorizing legislation (Section 1 and the preamble to the rule);
- # Section 202(a)(2)—a qualitative and quantitative assessment of the anticipated costs and benefits of the regulation, including administration costs to state and local governments (Sections 5 and 8);
- # Section 202(a)(3)(A)—accurate estimates of future compliance costs (as reasonably feasible; Section 5);
- # Section 202(a)(3)(B)—disproportionate effects on particular regions or segments of the private sector. EPA projects no impacts as a result of the rule, hence there are no disproportionate impacts (Chapter 6);
- # Section 202(a)(3)(B)—disproportionate effects on local communities. EPA projects no impacts as a result of the rule, hence there are no disproportionate impacts (Chapter 6) .
- # Section 202(a)(4)—estimated effects on the national economy (Chapter 6);
- # Section 205(a)—least burdensome option or explanation required (this Chapter).

² The \$100 million in annual costs is the same threshold that identifies a “significant regulatory action” in Executive Order 12866.

The preamble to the Rule summarizes the extent of EPA's consultation with stakeholders including industry, environmental groups, states, and local governments (UMRA, sections 202(a)(5) and 204). Because this rule does not “significantly or uniquely” affect small governments, section 203 of UMRA does not apply.

Pursuant to section 205(a)(1)-(2), EPA has selected the “least costly, most cost-effective or least burdensome alternative” consistent with the requirements of the Clean Water Act (CWA) for the reasons discussed in the preamble to the rule. EPA is required under the CWA (section 304, Best Available Technology Economically Achievable (BAT), and section 307, Pretreatment Standards for Existing Sources (PSES)) to set effluent limitations guidelines and standards based on BAT considering factors listed in the CWA such as age of equipment and facilities involved, and processes employed. EPA is also required under the CWA (section 306, New Source Performance Standards (NSPS), and section 307, Pretreatment Standards for New Sources (PSNS)) to set effluent limitations guidelines and standards based on Best Available Demonstrated Technology. EPA determined that the rule constitutes the least burdensome alternative consistent with the CWA.

9.3 REFERENCE

Katzen. 1995. Guidance for implementing Title II of S.I., Memorandum for the Heads of Executive Departments and Agencies from Sally Katzen, Ad, OIRA. March 31, 1995.

APPENDIX A

COST ANNUALIZATION MODEL

Figure A-1 provides an overview of the cost annualization model. Inputs to the model come from three sources: 1) the capital, one-time non-equipment, and operating and maintenance (O&M) costs for incremental pollution control developed by EPA, 2) financial data taken from the *Collection of 1997 Iron and Steel Industry Data, Part B: Financial and Economic Data* (1997 Questionnaire; U.S. EPA, 1998), and 3) secondary sources. The cost annualization model calculates four types of compliance costs for a site:

- # Present value of expenditures—before-tax basis
- # Present value of expenditures—after-tax basis
- # Annualized cost—before-tax basis
- # Annualized cost—after-tax basis

There are two reasons why the capital and O&M costs should be annualized. First, the initial capital outlay should not be compared against a site's income in the first year because the capital cost is incurred only once in the equipment's lifetime. That initial investment should be spread over the equipment's life. Second, money has a time value. A dollar today is worth more than a dollar in the future; expenditures incurred 15 years from now do not have the same value to the firm as the same expenditures incurred tomorrow.

The cost annualization model is defined in terms of 1997 dollars because 1997 is the most recent year for which financial data are available from the survey. Pollution control capital and operating and maintenance costs are estimated in 1997 dollars and used to project cash outflows. The cash outflows are then discounted to calculate the present value of future cash outflows in terms of 1997 dollars. This methodology evaluates what a business would pay in constant dollars for all initial and future expenditures. Finally, the model calculates the annualized cost for the cash outflow as an annuity that has the same present value of the cash outflows and includes the cost of money or interest. The annualized cost is analogous to a mortgage payment that spreads the one-time investment of a home into a defined series of monthly payments.

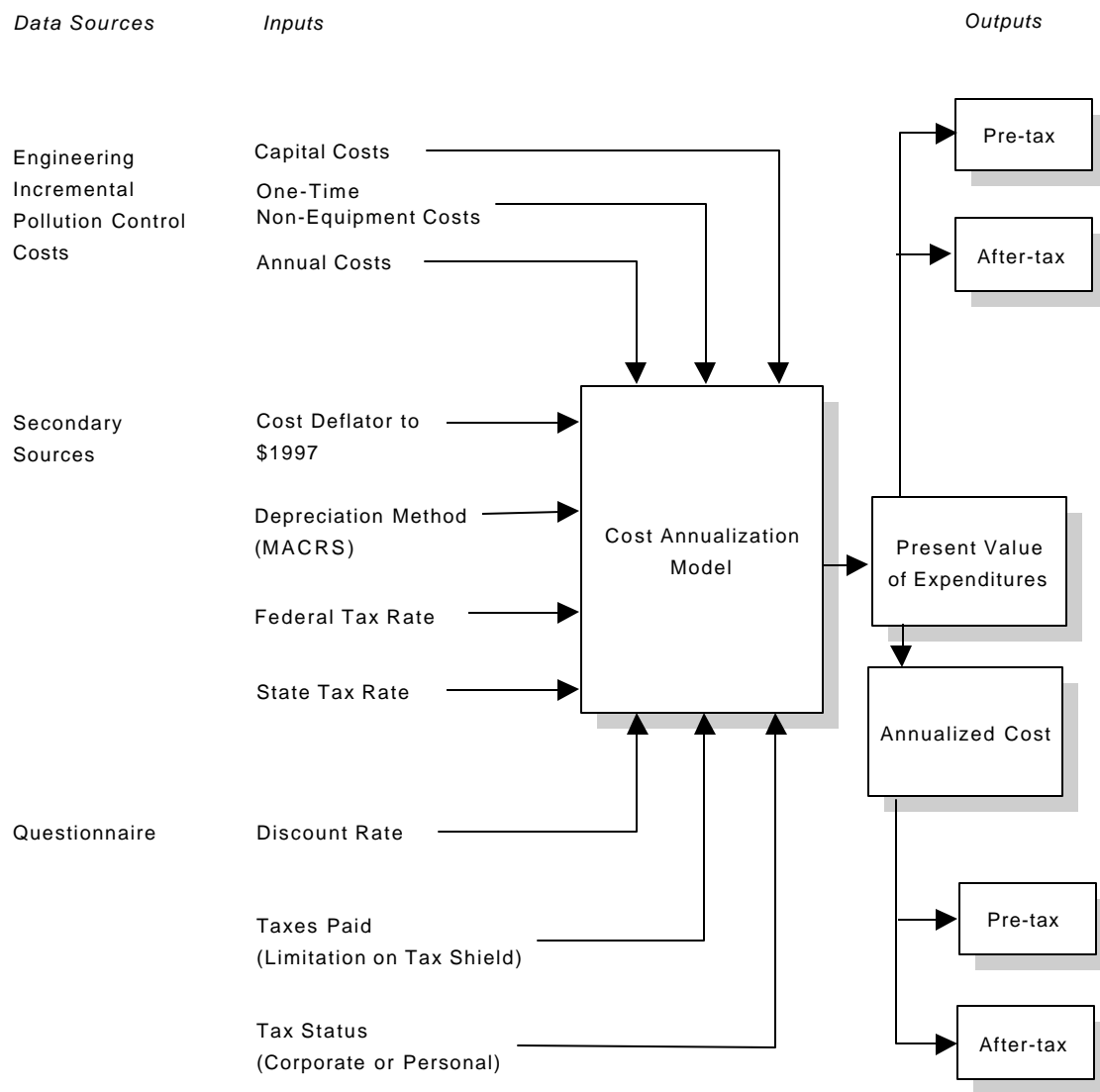


Figure A-1

Cost Annualization Model

Section A.1 discusses the data sources for inputs to the cost annualization model. Section A.2 summarizes the financial assumptions in the model. Section A.3 presents all steps of the model with a sample calculation.

A.1 INPUT DATA SOURCES

A.1.1 EPA Engineering Cost Estimates

The *capital, one-time non-equipment, and operating and maintenance* (O&M) costs used in the cost annualization model are developed by EPA's engineering staff. The capital cost is the initial investment needed to purchase and install the equipment; it is a one-time cost. Unlike capital costs, a one-time non-equipment cost cannot be depreciated because it is not associated with property that can wear out. An example of such a cost is an engineering study that recommends improved operating parameters as a method of meeting effluent limitations guidelines. No capital cost is associated with the plan's implementation. Such one-time costs are expensed in their entirety in the first year of the model. The O&M cost is the annual cost of operating and maintaining the equipment. O&M costs are incurred every year of the equipment's operation.

A.1.2 Questionnaire Data

The *discount/interest rate* is the either the weighted average cost of capital or the interest rate that a site supplied in the 1997 Questionnaire—whichever is higher (as long as it falls between 3 and 19 percent). It is used to calculate the present value of the cash flows. The discount rate represents an estimate of a site's marginal cost of capital, i.e. what it will cost the site to raise additional money for capital expenditure whether through debt (a loan), equity (sale of stock), or working capital (opportunity cost). The discount rate or weighted cost of capital is calculated as:

$$\text{Discount rate} = (\text{interest rate} * \% \text{ of capital raised through interest}) + (\text{equity rate} * \% \text{ of capital raised through equity [stock]})$$

For companies that do not use a discount rate, or provide a discount rate less than 3 percent or greater than 19 percent, the interest rate is used in the calculations. If no information was provided or if both the discount and interest rates fall outside the 3 percent to 19 percent range,¹ the median discount rate is used in the cost annualization model. The discount rate is assumed unaffected by the need to finance the purchase of pollution control equipment in order to comply with the regulation; in other words, the capital structure of the firm is assumed to be unchanged by the regulation (Brigham, 1997). Nineteen sites did not report either a discount or an interest rate. These sites finance expenditures through working capital. For these sites, we assign the median discount rate as the opportunity cost of capital.

Corporate structure is derived from survey data for the purpose of estimating tax shields on expenditures. A C corporation (corporate structure = 1) pays federal and state taxes at the corporate rate. An S corporation or a limited liability corporation (corporate structure = 3) distributes earnings to the partners and the individuals pay the taxes. Unfortunately, we do not know either the number of individuals among whom the earnings are distributed or the tax rate of those individuals. For the purpose of the analysis, the tax rate for S corporations and limited liability corporations is presumed to be zero.² All other entities (corporate structure = 2) are assumed to pay taxes at the individual rate.

Taxable income is the business entity's earnings before interest and taxes (EBIT). The value sets the tax bracket for the site.

Average taxes paid is calculated from the 1995, 1996, and 1997 taxes paid by the business entity. It is used to limit the tax shield to the typical amount of taxes paid in any given year.

¹ A rate less than 3 percent is suspiciously low given that, in 1997, banks charged a prime rate of 8.44 percent and the discount rate at the Federal Reserve Bank of New York was 5 percent (CEA, 1999). A rate greater than 19 percent is more likely to be an internal "hurdle" rate—the rate of return desired in a project before it will be undertaken. All but one of sites provided a discount rate that fell into the accepted range.

²The effect of this assumption is to assume there is no tax shield for S corporations and limited liability corporations (LLCs). S corporations and LLCs will see no change in tax shield benefit because they do not pay taxes. The persons to whom the income is distributed, however, will see the change in earnings due to incremental pollution control costs; there is no tax shield benefit.

A.1.3 Secondary Data

The cost annualization model is developed in terms of constant 1997 dollars, so the discount/interest rate must be adjusted for inflation before used in the model. That is, we need to change the discount rate from the nominal value supplied in the questionnaire to the inflation-adjusted real value. Table A-1 lists the average inflation rate from 1987 to 1997 as measured by the Consumer Price Index. The 10-year average inflation rate of 3.5 percent is used in the cost annualization model as the expected average inflation rate over the 15-year life of the project to convert the nominal discount rate to a real discount rate. The nominal discount rate is deflated to the real discount rate using the following formula (OMB, 1992):

$$\text{Real Discount Rate} = \left[\frac{(1 + \text{Nominal Discount Rate})}{(1 + \text{Expected Inflation Rate})} - 1 \right]$$

The median nominal discount rate for the industry (8.2 percent) is equivalent to a real discount rate of 4.5 percent using this formula.

Table A-2 lists each state's top corporate and individual tax rates and calculates national average state tax rates (CCH, 1999a). The cost annualization model uses the average state tax rate because of the complexities of the industry; for example, a site could be located in one state, while its corporate headquarters are located in a second state. Given the uncertainty over which state tax rate applies to a given site's revenues, the average state tax rate—rounded to three decimal points—is used in the cost annualization model for all sites, i.e., 6.6 percent corporate tax rate and 5.6 percent personal tax rate.

The cost annualization model incorporates variable tax rates according to the type of business entity and level of income to address differences between small and large businesses. For example, a large business might have a combined tax rate of 40.6 percent (34 percent Federal plus 6.6 percent State). After tax shields, the business would pay 59.4 cents for every dollar of incremental pollution control costs. A small business, say a small sole proprietorship, might be in the 20.8 percent tax bracket (15 percent Federal plus 5.8 percent State). After tax shields, the small business would pay 79.2 cents for every dollar of

Table A-1

Inflation Rate 1987-1997

Year	Consumer Price Index	Change
1987	113.6	
1988	118.3	4.1%
1989	124.0	4.8%
1990	130.7	5.4%
1991	136.2	4.2%
1992	140.3	3.0%
1993	144.5	3.0%
1994	148.2	2.6%
1995	152.4	2.8%
1996	156.9	3.0%
1997	160.5	2.3%
Average Inflation Rate		3.5%

Source: CEA, 1999, Table B-60.

Table A-2
State Income Tax Rates

State	Corporate Income Tax Rate	Basis for States With Graduated Tax Tables	Personal Income Tax Upper Rate	Basis for States With Graduated Tax Tables
Alabama	5.00%		5.00%	\$3,000+
Alaska	9.40%	\$90,000+	0.00%	
Arizona	8.00%		5.04%	\$150,000+
Arkansas	6.50%	\$100,000+	7.00%	\$25,000+
California	6.65%		9.30%	\$47,000
Colorado	4.75%		4.75%	
Connecticut	7.50%		4.50%	\$10,000+
Delaware	8.70%		6.40%	\$60,000+
Florida	5.50%		0.00%	
Georgia	6.00%		6.00%	\$10,000+
Hawaii	6.40%	\$100,000+	8.75%	\$40,000+
Idaho	8.00%		8.20%	\$20,000+
Illinois	4.80%		3.00%	
Indiana	3.40%		3.40%	
Iowa	12.00%	\$250,000+	8.98%	\$52,000+
Kansas	4.00%		6.45%	\$30,000+
Kentucky	8.25%	\$250,000+	6.00%	\$8,000+
Louisiana	8.00%	\$200,000+	6.00%	\$50,000+
Maine	8.93%	\$250,000+	8.50%	\$33,000+
Maryland	7.00%		4.80%	\$3,000+
Massachusetts	9.50%		5.95%	
Michigan	2.20%		4.40%	
Minnesota	9.80%		8.00%	\$50,000+
Mississippi	5.00%	\$10,000+	5.00%	\$10,000+
Missouri	6.25%		6.00%	\$9,000+
Montana	6.75%		11.00%	\$71,000+
Nebraska	7.81%	\$50,000+	6.99%	\$27,000+
Nevada	0.00%		0.00%	
New Hampshire	8.00%		0.00%	
New Jersey	7.25%		6.37%	\$75,000+
New Mexico	7.60%	\$1Million+	8.20%	\$42,000+
New York	7.50%		6.85%	\$20,000+
North Carolina	7.50%		7.75%	\$60,000+
North Dakota	10.50%	\$50,000+	12.00%	\$50,000+
Ohio	8.50%	\$50,000+	7.30%	\$200,000+
Oklahoma	6.00%		7.00%	
Oregon	6.60%		9.00%	\$5,000+
Pennsylvania	9.99%		2.80%	
Rhode Island	*		10.40%	\$250,000+
South Carolina	5.00%		7.00%	\$12,000+
South Dakota	6.00%		0.00%	
Tennessee	6.00%		0.00%	
Texas	0.00%		0.00%	
Utah	5.00%		7.00%	\$7,500+
Vermont	*	\$250,000+	9.45%	\$250,000+
Virginia	6.00%		5.75%	\$17,000+
Washington	0.00%		0.00%	
West Virginia	9.00%		6.50%	\$60,000+
Wisconsin	7.90%		6.77%	\$15,000+
Wyoming	0.00%		0.00%	
Average:	6.58%		5.59%	

Notes: Basis for rates is reported to nearest \$1,000.

Personal income tax rates for Rhode Island and Vermont based on federal tax (not taxable income).

Tax rates given here are equivalents for highest personal federal tax rate.

Source: CCH, 1999a. 2000 State Tax Handbook. Chicago, IL: CCH.

incremental pollution control. The net present value of after-tax cost is used in the closure analysis because it reflects the long-term impact on its income the business would actually experience.

All costs will be deflated to 1997 dollars, if necessary, for the cost annualization model. The Construction Cost Index published by the weekly *Engineering News Report*, is the indexed used for this purpose (ENR, 2000).

A.2 FINANCIAL ASSUMPTIONS

The cost annualization model incorporates several financial assumptions:

- # Depreciation method is the Modified Accelerated Cost Recovery System (MACRS).³ MACRS applies to assets put into service after December 31, 1986. MACRS allows businesses to depreciate a higher percentage of an investment in the early years and a lower percentage in the later years.

³EPA examined straight-line depreciation, Internal Revenue Code Section 169 and 179 provisions as well as MACRS for depreciation. Straight-line depreciation writes off a constant percentage of the investment each year. MACRS offers companies a financial advantage over the straight-line method because a company's taxable income may be reduced under MACRS by a greater amount in the early years when the time value of money is greater.

Section 169 provides an option to amortize pollution control equipment over a 5-year period (RIA, 1999). Under this provision, 75 percent of the investment could be rapidly amortized in a 5-year period using a straight-line method. The 75 percent figure is based on the ratio of allowable lifetime (15 years) to the estimated usable lifetime (20 years) as specified in Section 169, Subsection (f). Although the tax provision enables the site to expense the investment over a shorter time period, the advantage is substantially reduced because only 75 percent of the capital investment can be recovered. Because the benefit of the provision is slight and sites might not get the required certification to take advantage of it, the provision was not included in the cost annualization model.

EPA also considered the Section 179 provision to elect to expense up to \$24,000 if the equipment is placed into service in 2001 or 2002 (RIA, 1999). The deduction increased to \$25,000 if the equipment is placed into service in 2003 or later. EPA assumes that this provision is applied to other investments for the business entity. Its absence in the cost annualization model may result in a slightly higher estimate of the after-tax annualized cost for the site.

- # There is a six-month lag between the time of purchase and the time operation begins for the pollution control equipment. A mid-year depreciation convention may be used for equipment that is placed in service at any point within the year (CCH, 1999b, ¶1206). EPA chose to use a mid-year convention in the cost annualization model because of its flexibility and the likelihood that the equipment considered for pollution control could be built and installed within a year of initial investment. Because a half-year of depreciation is taken in the first year, a half-year needs to be taken in the 16th year of operation. Consequently, the cost annualization model spans a 16-year time period.
- # The pollution equipment has an operating lifetime or class life between 20 and 25 years. It is considered 15-year property.

The depreciable life of the asset is based on, but is not equivalent to, the useful life of the asset. The Internal Revenue Service (IRS) establishes different “classes” of property. For example, a race horse is 3-year property. The Internal Revenue Code Section 168 classifies an investment as 15-year property if it has a class life of 20 years or more but less than 25 years. Section 168(e)(3)(E) lists a municipal wastewater treatment plant as an example of 15-year property (CCH, 1999b, ¶1240; RIA, 1999). The cost annualization model, therefore, incorporates a 15-year depreciable lifetime. Thus, for the purpose of the calculating depreciation, most components of the pollution control capital costs considered in this analysis would be 15-year property. According to IRS requirements, pollution control equipment can be depreciated, but the total cost of the equipment cannot be subtracted from income in the first year. In other words, the equipment must be capitalized, not expensed (CCH, 1999b, ¶991; and RIA, 1999, Section 169).

A.3 SAMPLE COST ANNUALIZATION SPREADSHEET

In Table A-3, the spreadsheet contains numbered columns that calculate the before- and after-tax annualized cost of the investment to the site. The first column lists each year of the equipment's life span, from its installation through its 15-year depreciable lifetime.

Column 2 represents the percentage of the capital costs that can be written off or depreciated each year. These rates are based on the MACRS and are taken from CCH (1999b). Multiplying these depreciation rates by the capital cost gives the annual amount the site may depreciate, which is listed in Column 3. Depreciation expense is used to offset annual income for tax purposes; Column 4 shows the potential tax shield provided from the depreciation expense—the overall tax rate times the depreciation amount for the year.

Table A-3
Iron and Steel Cost Annualization Model

INPUTS		999		999	
Survey ID #:		1997	1997	1997	1997
Option Number:					
Initial Capital Cost (\$):		\$100,000	\$100,000		
Annual Operation & Maintenance Cost (\$):		\$1,000	\$1,000		
One-Time Non-Equipment Cost (\$):		\$10,000	\$10,000		
Facility-Specific Nominal Discount/Interest Rate:		7.0%			
Expected Inflation Rate:		3.5%			
Real Discount Rate:		3.4%			
Corporate Tax Structure		1			
EBIT (\$)		\$23,000			
Taxes Paid (3-yr average)		\$2,333			
Marginal Income Tax Rates:					
Federal		15.0%			
State		6.6%			
Combined		21.6%			
Engineering InputsEconomic Analysis					
Year Dollars		1997	1997	1997	1997
ENR CCI			5826	5826	5826
Federal Corp Tax Table:		Federal Personal Tax Table:			
	Taxable Income (\$)	Average Effective Tax Rate	Taxable Income (\$)	Average Effective Tax Rate	
	\$0	15.0%	\$0	15.0%	
	\$50,000	16.7%	\$22,750	18.8%	
	\$75,000	20.4%	\$55,100	24.8%	
	\$100,000	28.3%	\$115,000	29.5%	
	\$335,000	34.0%	\$250,000	37.8%	
surv_id					999
disc_rate					7.0%
corp_tax_ebit					1
opt_cap					\$23,000
opt_com					\$100,000
one_\$					\$1,000
tax_95					\$10,000
tax_96					\$3,000
tax_97					\$1,000

Column 1	Year	Depreciation Rate	3	4	5	6	7	8	9
Present Value	1	5.00%	\$5,000	\$1,080	\$10,500	\$2,268	\$110,500	\$2,333	\$108,167
	2	9.50%	\$9,500	\$2,052	\$1,000	\$216	\$1,000	\$2,268	(\$1,268)
	3	8.55%	\$8,550	\$1,847	\$1,000	\$216	\$1,000	\$2,063	(\$1,063)
	4	7.70%	\$7,700	\$1,663	\$1,000	\$216	\$1,000	\$1,879	(\$879)
	5	6.93%	\$6,930	\$1,497	\$1,000	\$216	\$1,000	\$1,713	(\$713)
	6	6.23%	\$6,230	\$1,346	\$1,000	\$216	\$1,000	\$1,562	(\$562)
	7	5.90%	\$5,900	\$1,274	\$1,000	\$216	\$1,000	\$1,490	(\$490)
	8	5.90%	\$5,900	\$1,274	\$1,000	\$216	\$1,000	\$1,490	(\$490)
	9	5.91%	\$5,910	\$1,277	\$1,000	\$216	\$1,000	\$1,493	(\$493)
	10	5.90%	\$5,900	\$1,274	\$1,000	\$216	\$1,000	\$1,490	(\$490)
	11	5.91%	\$5,910	\$1,277	\$1,000	\$216	\$1,000	\$1,493	(\$493)
	12	5.90%	\$5,900	\$1,274	\$1,000	\$216	\$1,000	\$1,490	(\$490)
	13	5.91%	\$5,910	\$1,277	\$1,000	\$216	\$1,000	\$1,493	(\$493)
	14	5.90%	\$5,900	\$1,274	\$1,000	\$216	\$1,000	\$1,490	(\$490)
	15	5.91%	\$5,910	\$1,277	\$1,000	\$216	\$1,000	\$1,493	(\$493)
	16	2.95%	\$2,950	\$637	\$500	\$108	\$500	\$745	(\$245)
Sum	100.00%	\$100,000	\$21,600	\$25,000	\$5,400	\$125,000		\$99,015	
Present Value		\$80,537	\$17,396	\$21,811	\$4,711	\$121,811		\$100,719	
Present Value of Incremental Costs:		After Tax Shield		Before Tax Shield					
Annualized Cost:		\$100,719		\$121,811					
		\$8,254		\$9,983					

Notes: This spreadsheet assumes that a modified accelerated cost recovery system (MACRS) is used to depreciate capital expenditures. Depreciation rates are from 1995 U.S. Master Tax Guide for 15-year property and mid-year convention.
Corporate Tax Structure: 1 = corporate tax rate 2 = individual tax rate 3 = S or Limited Liability corporations.
If the company-specific discount rate is $< 3\%$ or $> 19\%$, then an industry median figure of 8.2% is used.
First Year is not discounted.

Column 5 is the annual O&M expense and the one-time non-equipment cost. In this example, Year 1 shows the one-time non-equipment investment cost (\$10,000) plus six months of O&M ($\$1,000 \div 2 = \500) for a total of \$10,500. Year 1 and Year 16 show only six months of O&M expenses because of the mid-year convention assumption for depreciation. For Years 2 through 15, O&M is a constant amount. Column 6 is the potential tax shield or benefit provided from expensing the O&M costs.

Column 7 lists a site's annual pre-tax cash outflow or total expenses associated with the additional pollution control equipment. Total expenses include capital costs, assumed to be incurred during the first year when the equipment is installed, any one-time non-equipment cost, plus each year's O&M expense.

Column 8 is the adjusted tax shield. The potential tax shield is the sum of the tax shields from depreciation (Column 4) and O&M/one-time costs (Column 6). If the potential tax shield for any year exceeds the 3-year average taxes paid, the tax shield is limited to the average taxes paid by the company. In Table A-3 example, the potential tax shield in Year 1 is \$1,080 plus \$2,268 = \$3,348. The exceeds the average taxes paid over the last three years (\$2,333). Hence, the tax shield is limited to \$2,333. The limit is not invoked in any of the remaining years in the cost annualization model. This approach is conservative in that the limit is applied every year when a company may opt to carry losses forward to decrease tax liabilities in future years. An alternative approach is to limit the present value of the tax shield to the present value of taxes paid for the 15-year period. Should the first approach appear to overestimate cost impacts, the second approach may be examined as a sensitivity analysis.

Column 9 lists the annual cash outflow less the adjusted tax shield (Column 7 minus Column 8); a site will recover these costs in the form of reduced income taxes. The sum of the 16 years of after-tax expenses is \$125,000 (1997 dollars), i.e., the sum of the capital expense (\$1,000,000), the one-time expense (\$10,000) and 15 years of O&M (\$15,000). The present value of these payments is \$121,811 The present value calculation takes into account the time value of money and is calculated as:

$$\text{Present Value of Cash Outflows} = \sum_{i=1}^n \frac{\text{cash outflow, year}_i}{(1 + \text{real discount rate})^{i-1}}$$

The exponent in the denominator is $i-1$ because the real discount rate is not applied to the cash outflow in Year 1. The present value of the after-tax cash outflow is used in the closure analysis to calculate the post-regulatory present value of future earnings for a site.

The present value of the cash outflow is transformed into a constant annual payment for use as the annualized site compliance cost. The annualized cost is calculated as a 16-year annuity that has the same present value as the total cash outflow in Column 9. The annualized cost represents the annual payment required to finance the cash outflow after tax shields. In essence, paying the annualized cost each year and paying the amounts listed in Column 8 for each year are equivalent. The annualized cost is calculated as:

$$\text{Annualized Cost} = \text{Present value of cash outflows} * \frac{\text{real discount rate}}{1 - (\text{real discount rate} + 1)^{-n}}$$

where n is the number of payment periods. In this example, based on the capital investment of \$100,000, a one-time expense of \$10,000, O&M costs of \$1,000 per year, a tax rate of 21.6 percent, and a nominal discount rate of 7 percent, the site's annualized cost is \$9,983 on a pre-tax basis and \$8,254 on a post-tax basis.⁴

The pre-tax annualized cost is used in calculating the cost of the regulation. It incorporates the cost to industry for the purchase, installation, and operation of additional pollution control equipment as well as the cost to federal and state government from lost tax revenues. (Every tax dollar that a business does not pay due to a tax shield is a tax dollar lost to the government.) Post-tax annualized costs are used to shock the market model because they reflect the cost to industry.

⁴ Note that post-tax annualized cost can be calculated in two ways. The first way is to calculate the annualized cost as the difference between the annuity value of the cash flows (Column 7) and the adjusted tax shield (Column 8). The second way is to calculate the annuity value of the cash flows after tax shields (Column 9). Both methods yield the same result.

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Appendix B
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
Sector 21 -- Mining						
Subsector 212 -- Mining (except Oil and Gas)						
212111	Bituminous Coal and Lignite Surface Mining	E	500	500	1221	Bituminous Coal and Lignite Surface Mining
21221	Iron Ore Mining	E	500	500	1011	Iron Ores
Sector 22 -- Utilities						
Subsector 221 -- Utilities						
22121	Natural Gas Distribution	R	500	\$5.0	*4923	Natural Gas Transmission and Distribution (distribution)
				500	4924	Natural Gas Distribution
				\$5.0	4925	Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Distribution (natural gas distribution)
				\$5.0	*4931	Electronic and Other Services Combined (natural gas distribution)
				\$5.0	4932	Gas and Other Services combined (natural gas distribution)

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
				\$5.0	*4939	Combination Utilities, NEC (natural gas distribution)
Sector 23 -- Construction						
Subsector 233 -- Building, Developing and General Contracting						
23321	Single Family Housing Construction	R	\$17.0	\$17.0	1521	General contractors-Single-Family Houses
				\$17.0	*1531	Operative Builders (single-family housing construction)
Subsector 324 -- Petroleum and Coal Products Manufacturing						
32411	Petroleum Refineries		1,500	1,500	2911	Petroleum Refining
324199	All Other Petroleum and Coal Products Manufacturing		500	500	2999	Products of Petroleum and Coal, NEC
				1,000	*3312	Blast Furnaces and Steel Mills (coke ovens)
Subsector 325 -- Chemical Manufacturing						
32511	Petrochemical Manufacturing	N	1,000	750	*2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (aromatics)

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
				1,000	*2869	Industrial Organic Chemicals, NEC (aliphatics)
25132	Synthetic Organic Dye and Pigment Manufacturing	N	750	750	*2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (organic dyes and pigments)
Subsector 331 -- Primary Metal Manufacturing						
331111	Iron and Steel Mills	N	1,000	1,000	*3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills (except coke ovens not integrated with steel mills)
				750	*3399	Primary Metal Products, NEC (ferrous powder, paste, flakes, etc.)
33121	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	E	1,000	1,000	3317	Steel Pipe and Tubes
331221	Cold-Rolled Steel Shape Manufacturing	E	1,000	1,000	3316	Cold-Rolled Steel Sheet, Strip and Bars
331222	Steel Wire Drawing	R	1,000	1,000	*3315	Steel Wiredrawing and Steel Nails and Spikes (steel wire drawing)

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
331421	Copper Rolling, Drawing and Extruding	E	750	750	3351	Rolling, Drawing, and Extruding of Copper
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing and Extruding	R	750	750	3356	Rolling, Drawing and Extruding of Nonferrous Metals, Except Copper and Aluminum
331492	Secondary Smelting, Refining, and Allying of Nonferrous Metal (except Copper and Aluminum)	N	750	750	*3313	Electrometallurgical Products, Except Steel (except copper and aluminum)
				500	*3341	Secondary Smelting and Reining of Nonferrous Metals (except copper and aluminum)
				750	*3399	Primary Metal Products, NEC (except copper and aluminum)
331511	Iron Foundries	R	500	500	3321	Gray and Ductile Iron Foundries
				500	3322	Malleable Iron Foundries
331512	Steel Investment Foundries	E	500	500	3324	Steel Investment Foundries
331513	Steel Foundries, (except Investment)	E	500	500	3325	Steel Foundries, NEC

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
Subsector 332 - Fabricated Metal Product Manufacturing						
332117	Powder Metallurgy Part Manufacturing	N	500	500	*3499	Fabricated Metal Products, NEC (powder)
332439	Other Metal Container Manufacturing	R	500	500	3412	Metal Shipping Barrels, Drums, Kegs, and Pails
				500	*3429	Hardware, NEC (vacuum and insulated bottles, jugs, and chests)
				500	*3444	Sheet Metal Work (metal bins and vats)
				500	*3499	Fabricated Metal Products, NEC (metal boxes)
				750	*3537	Industrial Trucks, Tractors, Trailers, and Stackers (metal air cargo containers)
33251	Hardware Manufacturing	R	500	500	*3429	Hardware, NEC (hardware, except hose nozzles, and vacuum and insulated bottles, jugs and chests)
				500	*3499	Fabricated Metal Products, NEC (safe and vault locks)

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
332618	Other Fabricated Wire Product Manufacturing	R	500	1,000	*3315	Steel Wiredrawing and Steel Nails and Spikes (nails, spikes, paper clips and wire not made in wiredrawing plants)
				750	*3399	Primary Metal Products, NEC (nonferrous nails, brads, staples, etc.)
				500	3496	Miscellaneous Fabricated Wire Products
332812	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	R	500	500	*3479	Coating, Engraving, and Allied Services, NEC (except jewelry, silverware, and flatware engraving and etching)
332813	Electroplating, Plating, Polishing, Anodizing and Coloring	R	500	750	*3399	Primary Metal Products, NEC (laminating steel)
				500	3471	Electroplating, Plating, Polishing, Anodizing, and Coloring
332991	Ball and Roller Bearing Manufacturing	E	750	750	3562	Ball and Roller Bearings

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
Subsector 333 -- Machinery Manufacturing						
333319	Other Commercial and Service Industry Machinery Manufacturing	R	500	500	*3559	Special Industry Machinery, NEC (automotive maintenance equipment)
				500	3589	Service Industry Machinery, NEC
				500	*3599	Industrial and Commercial Machinery and Equipment, NEC (carnival amusement park equipment)
				750	*3699	Electrical Machinery, Equipment and Supplies, NEC (electronic teaching machines and flight simulators)
333618	Other Engine Equipment Manufacturing	R	1,000	1,000	*3519	Internal Combustion Engines, NEC (except stationary engine radiators)
				750	*3699	Electrical Machinery, Equipment and Supplies, NEC (outboard electric motors)
Subsector 334 -- Computer and Electronic Product Manufacturing						
334413	Semiconductor and Related Device	E	500	500	3674	Semiconductors and Related Devices

Appendix B (cont.)
Cross-reference Between NAICS and SIC Codes

1997 NAICS code	1997 NAICS industry description	New, Existing or Revised Industry	Proposed size standard (\$ million or emp #) for NAICS industry	Existing size standard (\$ million or emp #) for SIC activity	1987 SIC code (* = part of SIC code)	1987 SIC industry
Subsector 339 -- Miscellaneous Manufacturing						
339911	Jewelry (except Costume) Manufacturing	R	500	500	*3469	Metal Stamping, NEC (stamping coins)
				500	*3479	Coating, Engraving, and Allied Services, NEC (jewelry engraving and etching, including precious metal)
Sector 42 - Wholesale Trade						
Subsector 421 -- Wholesale Trade, Durable Goods						
42151	Metal Service Centers and Offices	E	100	100	5051	Metals Service Centers and Offices
42193	Recyclable Material Wholesalers	E	100	100	5093	Scrap and Waste Materials
Subsector 422 -- Wholesale Trade, Nondurable Goods						
42251	Grain and Field Bean Wholesalers	E	100	100	5153	Grain and Field Beans
Sector 55 -- Management of Companies and Enterprises						
Subsector 551 -- Management of Companies and Enterprises						
551111	Offices of Bank Holding Companies	E	\$5.0	\$5.0	6712	Offices of Bank Holding Companies
551112	Offices of Other Holding Companies	E	\$5.0	\$5.0	6719	Offices of Holding Companies, NEC

Source: Federal Register, 22 October 1999

APPENDIX C

COST-EFFECTIVENESS ANALYSIS

C.1 INTRODUCTION

This cost-effectiveness (CE) analysis presents an evaluation of the technical efficiency of pollutant control options for the final effluent limitations guidelines and standards for the iron and steel manufacturing point source category based on Best Available Technology Economically Achievable (BAT) and Pretreatment Standards for Existing Sources (PSES). BAT standards set effluent limitations on toxic and nonconventional pollutants for direct dischargers prior to wastewater discharge directly into a water body such as a stream, river, lake, estuary, or ocean. Indirect dischargers send wastewater to publicly owned treatment works (POTW) for further treatment prior to discharge to U.S. surface waters; PSES set limitations for indirect dischargers on pollutants which pass through a POTW.

Section C.2 discusses EPA's cost-effectiveness methodology and identifies the pollutants included in the analysis. This section also presents EPA's toxic weighting factors for each pollutant and discusses POTW removal factors for indirect dischargers. Section C.3 presents the cost-effectiveness analysis. Section C.4 contains supplementary data tables while Section C.5 lists references.

C.2 COST-EFFECTIVENESS METHODOLOGY

C.2.1 Overview

Cost-effectiveness is evaluated as the incremental annualized cost of a pollution control option in an industry or industry subcategory per incremental pound equivalent of pollutant (i.e., pound of pollutant adjusted for toxicity) removed by that control option. EPA uses the cost-effectiveness analysis primarily to compare the removal efficiencies of regulatory options under consideration for a rule. A secondary and less effective use is to compare the cost-effectiveness of the promulgated options for the iron and steel manufacturing industry to those for effluent limitation guidelines and standards for other industries.

To develop a cost-effectiveness study, the following steps must be taken to define the analysis or generate data used for calculating values:

- # Determine the pollutants effectively removed from the wastewater.
- # For each pollutant, identify the toxic weights and POTW removal factors. (The first adjusts the removals to reflect the relative toxicity of the pollutants while the second reflects the ability of a POTW or sewage treatment plant to remove pollutants prior to discharge to the water. These are described in Sections C.2.2 and C.2.3.)
- # Define the regulatory pollution control options.
- # Calculate pollutant removals for each pollution control option.
- # Calculate the product of the pollutant removed (in pounds), the toxic weighting factor, and the POTW removal factor. The resultant removal is specified in terms of “pound-equivalents” removed.
- # Determine the annualized cost of each pollution control option.
- # Rank the pollution control options in order of increasing pound equivalents removed.
- # Identify and delete from consideration ineffective options.
- # Calculate incremental CE for remaining options.

Table C-1 presents the pollutants, their toxic weights, and POTW removal factors used in the CE calculations.

C.2.2 Toxic Weighting Factors

Cost-effectiveness analyses account for differences in toxicity among the pollutants using toxic weighting factors. Accounting for these differences is necessary because the potentially harmful effects on human and aquatic life are specific to the pollutant. For example, a pound of zinc in an effluent stream has a significantly different, less harmful effect than a pound of PCBs. Toxic weighting factors for pollutants are derived using ambient water quality criteria and toxicity values. For most industries, toxic weighting factors are developed from chronic freshwater aquatic criteria. In cases where a human health criterion has

Table C-1

Toxic Weighting Factors and POTW Removal Factors for Pollutants

Pollutant Name	Toxic Weighting Factor	POTW Removal Factor
1,2,3,4,6,7,8-Heptachlorodibenzofuran	6.70E+005	0%
1,2,3,4,7,8-Hexachlorodibenzofuran	6.70E+006	0%
1,2,3,6,7,8-Hexachlorodibenzofuran	6.70E+006	0%
1,2,3,7,8-Pentachlorodibenzofuran	3.30E+006	0%
2-Methylnaphthalene	8.00E-002	28%
2-Phenylnaphthalene	1.50E-001	85%
2,3,4,6,7,8-Hexachlorodibenzofuran	6.70E+006	0%
2,3,4,7,8-Pentachlorodibenzofuran	3.30E+007	0%
2,3,7,8-Tetrachlorodibenzofuran	6.70E+006	0%
2,4-Dimethylphenol	5.30E-003	51%
4-Nitrophenol	9.40E-003	0%
Acetone	5.00E-006	84%
alpha-Terpineol	1.10E-003	94%
Aluminum	6.40E-002	91%
Ammonia As Nitrogen (NH3-N)	1.80E-003	39%
Aniline	1.40E+000	93%
Antimony	4.80E-003	67%
Arsenic	3.50E+000	66%
Barium	2.00E-003	55%
Benzene	1.80E-002	95%
Benzo(a)anthracene	1.80E+002	98%
Benzo(a)pyrene	4.30E+003	95%
Benzo(b)fluoranthene	4.20E+002	95%
Bis(2-ethylhexyl) Phthalate	9.50E-002	60%
Boron	1.80E-001	24%
Cadmium	2.60E+000	90%
Chromium	7.60E-002	80%
Chromium, Hexavalent	5.10E-001	6%
Chrysene	2.10E+000	97%
Cobalt	1.10E-001	10%
Copper	6.30E-001	84%
Dibenzofuran	2.00E-001	98%
Fluoranthene	8.00E-001	42%
Fluoride	3.50E-002	54%
Hexanoic Acid	3.70E-004	84%
Iron	5.60E-003	82%
Lead	2.20E+000	77%
Magnesium	8.70E-004	14%
Manganese	7.00E-002	36%
Mercury	1.20E+002	90%
Molybdenum	2.00E-001	19%
Naphthalene	1.50E-002	95%
n-Dodecane	4.30E-003	95%
n-Eicosane	4.30E-003	92%
n-Hexadecane	4.30E-003	71%
Nickel	1.10E-001	51%
Nitrate/Nitrite (NO2 + NO3-N)	6.20E-005	90%
n-Octadecane	4.30E-003	71%
o-Cresol	2.70E-003	53%
p-Cresol	4.00E-003	72%
Phenanthrene	2.90E-001	95%
Phenol	2.80E-002	95%
Pyrene	1.10E-001	84%
Pyridine	1.30E-003	95%
Selenium	1.10E+000	34%
Silica Gel Treated-HEM (SGT-HEM)		87%
Thallium	1.00E+000	50%
Thiocyanate	1.20E-001	70%
Tin	3.00E-001	43%
Titanium	2.90E-002	92%
Total Cyanide	1.10E+000	70%
Vanadium	6.20E-001	8%

also been established for the consumption of fish, the sum of both the human and aquatic criteria are used to derive toxic weighting factors. The factors are standardized by relating them to a “benchmark” toxicity value, which was based on the toxicity of copper when the methodology was developed.¹

Examples of the effects of different aquatic and human health criteria on freshwater toxic weighting factors are presented in Table C-2. As shown in this table, the toxic weighting factor is the sum of two criteria-weighted ratios: the former benchmark copper criterion divided by the human health criterion for the particular pollutant and the former benchmark copper criterion divided by the aquatic chronic criterion. For example, using the values reported in Table C-2, four pounds of the benchmark chemical (copper) pose the same relative hazard in freshwater as one pound of cadmium because cadmium has a freshwater toxic weight four times greater than the toxic weight of copper (2.6 divided by 0.63 equals 4.13).

C.2.3 POTW Removal Factors

Calculating pound equivalents for direct dischargers differs from calculating for indirect dischargers because of the ability of POTWs to remove certain pollutants. The POTW removal factors are used as follows: If a facility is discharging 100 pounds of chromium in its effluent stream to a POTW and the POTW has a 80 percent removal efficiency for chromium, then the chromium discharged to surface waters is only 20 pounds (1 minus 0.8 equals 0.2). If the regulation reduces chromium discharged in the effluent stream to the POTW by 50 pounds, then the amount discharged to surface waters is calculated as 50 pounds multiplied by the POTW removal factor (50 pounds times 0.2 equals 10 pounds). The cost-effectiveness calculations then reflect the fact that the actual reduction of pollutant discharged to surface water is not 50 pounds (the change in the amount discharged to the POTW), but 10 pounds (the change in the amount actually discharged to surface water). A pollutant discharge that is unaffected by the POTW has a removal factor of 1.

¹ Although the water quality criterion has been revised (to 9.0 µg/l), all cost-effectiveness analyses for effluent guideline regulations continue to use the former criterion of 5.6 µg/l as a benchmark so that cost-effectiveness values can continue to be compared to those for other effluent guidelines. Where copper is present in the effluent, the revised higher criterion for copper results in a toxic weighting factor for copper of 0.63 rather than 1.0.

Table C-2

**Examples of Toxic Weighting Factors
Based on Copper Freshwater Chronic Criteria**

Pollutant	Human Health Criteria (µg/l)	Aquatic Chronic Criteria (µg/l)	Weighting Calculation	Toxic Weighting Factor
Copper*	1,200	9.0	$5.6/1,200 + 5.6/9.0$	0.63
Cadmium	84	2.2	$5.6/84 + 5.6/2.2$	2.6
Naphthalene	21,000	370	$5.6/21,000 + 5.6/370$	0.015

* The water quality criterion has been revised (to 9.0 µg/l). Formerly, the weighting factor calculation led to a result of 0.47 as a toxic weighting factor for copper.

Notes: Human health and aquatic chronic criteria are maximum contamination thresholds. Units for criteria are micrograms of pollutant per liter of water.

C.2.4 Pollutant Removals And Pound-equivalent Calculations

The pollutant loadings have been calculated for each facility under each regulatory pollution control option for comparison with baseline (i.e., current practice) loadings. Pollutant removals are calculated simply as the difference between current and post-treatment discharges. These pollutant removals are converted into pound equivalents for the cost-effectiveness analysis. For direct dischargers, removals in pound equivalents are calculated as:

$$\text{Removals}_{\text{pe}} = \text{Removals}_{\text{pounds}} \times \text{Toxic weighting factor}$$

For indirect dischargers, removals in pound equivalents are calculated as:

$$\text{Removals}_{\text{pe}} = \text{Removals}_{\text{pounds}} \times \text{Toxic weighting factor} \times \text{POTW removal factor}$$

Total removals for each option are then calculated by adding up the removals of all pollutants included in the cost-effectiveness analysis for a given subcategory.

C.2.5 Calculation Of Incremental Cost-effectiveness Values

Cost-effectiveness ratios are calculated separately for direct and indirect dischargers and by subcategory. Within each of these many groupings, the pollution control options are ranked in ascending order of pound equivalents removed. The incremental cost-effectiveness value for a particular control option is calculated as the ratio of the incremental annual cost to the incremental pound equivalents removed. The incremental effectiveness may be viewed primarily in comparison to the baseline scenario and to other regulatory pollution control options. Cost-effectiveness values are reported in units of dollars per pound equivalent of pollutant removed.

For the purpose of comparing cost-effectiveness values of options under review to those of other promulgated rules, compliance costs used in the cost-effectiveness analysis are adjusted to 1981

dollars using *Engineering News Record's* Construction Cost Index (CCI), see ENR 2000. The adjustment factor is calculated as follows:

$$\text{Adjustment factor} = 1981 \text{ CCI} / 1997 \text{ CCI} = 3535 / 5826 = 0.607$$

The equation used to calculate incremental cost-effectiveness is:

$$CE_k = \frac{ATC_k - ATC_{k-1}}{PE_k - PE_{k-1}}$$

where:

CE_k =	Cost-effectiveness of Option k
ATC_k =	Total annualized treatment cost under Option k
PE_k =	Pound equivalents removed by Option k

Cost-effectiveness measures the incremental unit cost of pollutant removal of Option k (in pound equivalents) in comparison to Option k-1. The numerator of the equation, ATC_k minus ATC_{k-1} , is simply the incremental annualized treatment cost in moving from Option k-1 (an option that removes fewer pound equivalents of pollutants) to Option k (an option that removes more pound equivalents of pollutants). Similarly, the denominator is the incremental removals achieved in going from Option k-1 to k.

C.3 COST-EFFECTIVENESS ANALYSIS

Chapter 5 presents the options and costs for each of the subcategories considered by EPA. Pre-tax annualized costs are used in the CE calculations. Section C.4 contains the supplementary pound and pound-equivalent tables for the analysis. The total pounds removed in these tables may differ from those presented in the Technical Development Document because the costs and removals for sites projected to close prior to the implementation of the rule have been deleted from the analysis. For a site which is projected to close as a result of the rule, the compliance costs are included but the removals are the entire discharge of the site.

C.3.1 Subcategory Cost-effectiveness

Table C-3 shows the incremental CE tables for direct (BAT) and indirect (PSES) dischargers in all subcategories that regulate toxic and nonconventional pollutants. That is, the “other operations” subcategory considers the removal of only conventional pollutants and is not included in Table C-3. For PSES cokemaking, the CE ranges from \$45 to \$61 per pound-equivalent. All other subcategories have one BAT and one PSES option.

C.3.2 Industry Cost-effectiveness

Tables C-4, and C-5 list the incremental annualized cost and the incremental removals for the final options for each subcategory. The incremental values are totals to provide the industry cost-effectiveness ratios. For BAT, the industry CE ratio is \$21 per pound-equivalent. For PSES, the industry CE ratio is \$45 per pound-equivalent.

Tables C-6 and C-7 summarize the cost-effectiveness of the final rule for the iron and steel manufacturing industry relative to that of other industries for direct and indirect dischargers, respectively.

C.4 SUPPLEMENTAL TABLES

Tables C-8 to C-13 present pollutant removals for all options for direct dischargers. Tables C-14 and C-15 show pollutant removals for indirect dischargers. Baseline loads for each subcategory are illustrated in Tables C-16 through C-23. All tables in this section present pounds removed and pound equivalents removed.

C.5 REFERENCE

Engineering News Record. 2000. Construction cost index history, 1907-2000. Engineering News Record. March 27.

Table C-3

Results of Cost-Effectiveness Analyses by Subcategory

Subcategory	Segment	Regulatory Option	Pre-Tax Annualized Costs (Millions of \$1997)	Pollutant Removals (Pound Equivalents)	Pre-Tax Incremental Cost-Effectiveness (\$1981 Per Pound-Equivalent Removed)
Cokemaking		BAT 1	\$6.49	185,441	\$21
		BAT 3	\$10.60	228,889	\$58
		PSES 1	\$1.93	26,251	\$45
		PSES 3	\$7.07	77,783	\$61
Sintering		BAT 1	\$2.57	14,515	\$107
Integrated Steelmaking		BAT 1	\$12.86	94,494	\$83
Integrated and Stand-Alone Hot-Forming	Carbon	BAT 1	\$33.77	247,280	\$83
Non-Integrated Steelmaking and Hot-Forming	Carbon	BAT 1	\$6.03	3,891	\$941
	Stainless	BAT 1	\$0.78	230	\$2,069
	Stainless	PSES 1	\$0.25	78	\$1,970

Table C-4

**Incremental Cost-Effectiveness of Pollutant Control Options
Iron and Steel Manufacturing Point Source Category
Direct Dischargers**

Subcategory	Segment	Incremental		
		Pre-Tax Annualized Cost (Millions of \$1997)	Pound Equivalents Removed	Cost-Effectiveness (\$1981/Pound Equivalents)
Cokemaking		\$6.49	185,441	\$21
Sintering		\$2.57	14,515	\$107
Industry Total		\$9.06	199,956	\$27

Table C-5

**Incremental Cost-Effectiveness of Pollutant Control Options
Iron and Steel Manufacturing Point Source Category
Indirect Dischargers**

Subcategory	Segment	Incremental		
		Pre-Tax Annualized Cost (Millions of \$1997)	Pound Equivalents Removed	Cost-Effectiveness (\$1981/Pound Equivalents)
Cokemaking		\$1.93	26,251	\$45
Industry Total		\$1.93	26,251	\$45

Table C-6

**Industry Comparison of BAT Cost-Effectiveness
For Direct Dischargers
(Toxic and Nonconventional Pollutants Only; Copper-Based Weights^a; \$ 1981)**

Industry	Pound Equivalents Currently Discharged (thousands)	Pound Equivalents Remaining at Selected Option (thousands)	Cost-Effectiveness of Selected Option(s) (\$/ Pound Equivalents removed)
Aluminum Forming	1,340	90	121
Battery Manufacturing	4,126	5	2
Canmaking	12	0.2	10
Centralized Waste Treatment ^c	3,372	1,261-1,267	5-7
Coal Mining	BAT=BPT	BAT=BPT	BAT=BPT
Coil Coating	2,289	9	49
Copper Forming	70	8	27
Electronics I	9	3	404
Electronics II	NA	NA	NA
Foundries	2,308	39	84
Inorganic Chemicals I	32,503	1,290	<1
Inorganic Chemicals II	605	27	6
Iron & Steel	1,053	853	27
Leather Tanning	259	112	BAT=BPT
Metal Finishing	3,305	3,268	12
Metal Products and Machinery ^c	140	70	50
Nonferrous Metals Forming	34	2	69
Nonferrous Metals Mfg I	6,653	313	4
Nonferrous Metals Mfg II	1,004	12	6
Oil and Gas: Offshore ^b	3,809	2,328	33
Coastal—Produced Water/TWC	951	239	35
Drilling Waste	BAT = Current Practice	BAT = Current Practice	BAT = Current Practice
Organic Chemicals	54,225	9,735	5
Pesticides	2,461	371	14
Pharmaceuticals ^c A/C	897	47	47
B/D	90	0.5	96
Plastics Molding & Forming	44	41	BAT=BPT
Porcelain Enameling	1,086	63	6
Petroleum Refining	BAT=BPT	BAT=BPT	BAT=BPT
Pulp & Paper ^c	61,713	2,628	39
Textile Mills	BAT=BPT	BAT=BPT	BAT=BPT
TEC: TB/CHEM&PETR TT & RT/CHEM&PETR	BAT=BPT 1	BAT=BPT ND	BAT=BPT 323

^aAlthough toxic weighting factors for priority pollutants varied across these rules, this table reflects the cost-effectiveness at the time of regulation.

^bProduced water only; for produced sand and drilling fluids and drill cuttings, BAT=NSPS.

ND: Nondisclosed due to business confidentiality.

Table C-7

**Industry Comparison of PSES Cost-Effectiveness
For Indirect Dischargers
(Toxic and Nonconventional Pollutants Only; Copper-Based Weights^a; \$ 1981)**

Industry^b	Pound Equivalents Currently Discharged (To Surface Waters) (thousands)	Pound Equivalents Discharged at Selected Option (To Surface Waters) (thousands)	Cost-Effectiveness of Selected Option(s) Beyond BPT (\$/Pound Equivalents removed)
Aluminum Forming	1,602	18	155
Battery Manufacturing	1,152	5	15
Canmaking	252	5	38
Centralized Waste Treatment ^c	689	328-330	70-110
Coal Mining	NA	NA	NA ^c
Coil Coating	2,503	10	10
Copper Forming	934	4	10
Electronics I	75	35	14
Electronics II	260	24	14
Foundries	2,136	18	116
Inorganic Chemicals I	3,971	3,004	9
Inorganic Chemicals II	4,760	6	<1
Iron & Steel	91	64	45
Leather Tanning	16,830	1,899	111
Metal Finishing	11,680	755	10
Metal Products and Machinery ^c	1,115	234	127
Nonferrous Metals Forming	189	5	90
Nonferrous Metals Mfg I	3,187	19	15
Nonferrous Metals Mfg II	38	0.41	12
Organic Chemicals	5,210	72	34
Pesticide Manufacturing	257	19	18
Pesticide Formulating	7,746	112	<3
Pharmaceuticals ^c	340	63	1
Plastics Molding & Forming	NA	NA	NA
Porcelain Enameling	1,565	96	14
Pulp & Paper ^c	9,539	103	65
Transportation Equipment Cleaning	81	43	148

^aAlthough toxic weighting factors for priority pollutants varied across these rules, this table reflects the cost-effectiveness at the time of regulation.

^bNo known indirect dischargers at this time for offshore oil and gas and coastal oil and gas.

^cProposed.

Table C-8

Pollutant Removals
Cokemaking Subcategory
Direct Dischargers

Chemical Name	Pounds Removed		Toxic Weighting Factor	Pound Equivalents (PE) Removed	
	Option 1	Option 3		Option 1	Option 3
2,4-Dimethylphenol	3	11	5.3E-003	0.0	0.1
2-Methylnaphthalene	53	62	8.0E-002	4.2	4.9
2-Phenylnaphthalene	4	11	1.5E-001	0.6	1.6
Acetone	24	58	5.0E-006	0.0	0.0
Ammonia As Nitrogen (NH3-N)	411,340	431,440	1.8E-003	740.4	776.6
Aniline	5	12	1.4E+000	7.6	17.3
Benzene	11	15	1.8E-002	0.2	0.3
Benzo(a)anthracene	20	11	1.8E+002	3,659.9	1,916.0
Benzo(a)pyrene	28	35	4.3E+003	121,341.7	148,608.0
Benzo(b)fluoranthene	3	8	4.2E+002	1,100.8	3,272.2
Chrysene	19	11	2.1E+000	39.9	22.4
Dibenzofuran	4	11	2.0E-001	0.8	2.2
Fluoranthene	37	11	8.0E-001	29.9	8.5
Mercury	1	1	1.2E+002	145.3	174.1
n-Eicosane	4	11	4.3E-003	0.0	0.0
n-Octadecane	4	11	4.3E-003	0.0	0.0
Naphthalene	22	32	1.5E-002	0.3	0.5
Nitrate/Nitrite (NO2 + NO3-N)	0	76,100	6.2E-005	0.0	4.7
o-Cresol	23	31	2.7E-003	0.1	0.1
p-Cresol	5	12	4.0E-003	0.0	0.0
Phenanthrene	3	11	2.9E-001	1.0	3.2
Phenol	121	136	2.8E-002	3.4	3.8
Pyrene	30	11	1.1E-001	3.3	1.2
Pyridine	6	13	1.3E-003	0.0	0.0
Selenium	1,461	1,759	1.1E+000	1,606.7	1,934.5
Thiocyanate	298,710	299,421	1.2E-001	35,845.2	35,930.5
Total Cyanide	19,009	32,915	1.1E+000	20,909.9	36,206.5
Total	730,951	842,157		185,441	228,889

Table C-9

Pollutant Removals
Sintering Subcategory
Direct Dischargers

Chemical Name	Pounds Removed	Toxic Weighting Factor	Pound Equivalents (PE) Removed
	Option 1		Option 1
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.0003	6.7E+005	182.0
1,2,3,4,7,8-Hexachlorodibenzofuran	0.0002	6.7E+006	1,080.7
1,2,3,6,7,8-Hexachlorodibenzofuran	0.0001	6.7E+006	791.9
1,2,3,7,8-Pentachlorodibenzofuran	0.0002	3.3E+006	502.3
2,3,4,6,7,8-Hexachlorodibenzofuran	0.0001	6.7E+006	440.8
2,3,4,7,8-Pentachlorodibenzofuran	0.0003	3.3E+007	9,296.1
2,3,7,8-Tetrachlorodibenzofuran	0.0003	6.7E+006	2,221.1
2,4-Dimethylphenol	0.0	5.3E-003	0.0
4-Nitrophenol	0.0	9.4E-003	0.0
Aluminum	0.0	6.4E-002	0.0
Amenable Cyanide	0.0	0.0E+000	0.0
Ammonia As Nitrogen (NH3-N)	0.0	1.8E-003	0.0
Arsenic	0.0	3.5E+000	0.0
Boron	0.0	1.8E-001	0.0
Cadmium	0.0	2.6E+000	0.0
Chromium	0.0	7.6E-002	0.0
Copper	0.0	6.3E-001	0.0
Fluoranthene	0.0	8.0E-001	0.0
Fluoride	0.0	3.5E-002	0.0
Iron	0.0	5.6E-003	0.0
Lead	0.0	2.2E+000	0.0
Magnesium	0.0	8.7E-004	0.0
Manganese	0.0	7.0E-002	0.0
Mercury	0.0	1.2E+002	0.0
Molybdenum	0.0	2.0E-001	0.0
Nickel	0.0	1.1E-001	0.0
Nitrate/Nitrite (NO2 + NO3-N)	0.0	6.2E-005	0.0
o-Cresol	0.0	2.7E-003	0.0
p-Cresol	0.0	4.0E-003	0.0
Phenanthrene	0.0	2.9E-001	0.0
Phenol	0.0	2.8E-002	0.0
Pyridine	0.0	1.3E-003	0.0
Selenium	0.0	1.1E+000	0.0
Thallium	0.0	1.0E+000	0.0
Thiocyanate	0.0	1.2E-001	0.0
Titanium	0.0	2.9E-002	0.0
Total Cyanide	0.0	1.1E+000	0.0
Zinc	0.0	4.7E-002	0.0
Total	0.0014		14,515

Table C-10

Pollutant Removals
Integrated Steelmaking Subcategory
Direct Dischargers

Chemical Name	Pounds Removed	Toxic Weighting Factor	Pound Equivalents (PE) Removed
	Option 1		Option 1
Aluminum	46,900	6.4E-002	3,002
Ammonia As Nitrogen (NH ₃ -N)	15,985	1.8E-003	29
Cadmium	206	2.6E+000	535
Chromium	526	7.6E-002	40
Copper	812	6.3E-001	512
Fluoride	2,080,790	3.5E-002	72,828
Iron	235,988	5.6E-003	1,322
Lead	3,186	2.2E+000	7,009
Magnesium	1,825,000	8.7E-004	1,588
Manganese	12,947	7.0E-002	906
Molybdenum	22,134	2.0E-001	4,427
Nitrate/Nitrite (NO ₂ + NO ₃ -N)	0	6.2E-005	0
Tin	342	3.0E-001	103
Titanium	380	2.9E-002	11
Vanadium	674	6.2E-001	418
Zinc	37,599	4.7E-002	1,767
Total	4,283,467		94,494

Table C-11

Pollutant Removals
Integrated and Standalone Hot Forming Subcategory
Direct Dischargers - Carbon Segment

	Pounds Removed	Toxic Weighting Factor	Pound Equivalents (PE) Removed
Chemical Name	Option 1		Option 1
Ammonia As Nitrogen (NH ₃ -N)	637,974.1	1.8E-003	1,148.4
Fluoride	4,171,246.1	3.5E-002	145,993.6
Iron	7,009,176.7	5.6E-003	39,251.4
Lead	19,357.7	2.2E+000	42,587.0
Manganese	63,932.7	7.0E-002	4,475.3
Molybdenum	52,564.8	2.0E-001	10,513.0
Zinc	70,451.6	4.7E-002	3,311.2
Total	12,024,704		247,280

Table C-12

Pollutant Removals
Non-Integrated Steelmaking and Hot Forming Subcategory
Direct Dischargers - Carbon Segment

Chemical Name	Pounds Removed	Toxic Weighting Factor	Pound Equivalents (PE) Removed
	Option 1		Option 1
Ammonia As Nitrogen (NH3-N)	0.0	1.8E-003	0.0
Boron	0.0	1.8E-001	0.0
Copper	0.0	6.3E-001	0.0
Fluoride	15,687.2	3.5E-002	549.1
Iron	97,106.6	5.6E-003	543.8
Lead	677.9	2.2E+000	1,491.4
Manganese	13,214.0	7.0E-002	925.0
Molybdenum	1,213.4	2.0E-001	242.7
Nitrate/Nitrite (NO2 + NO3-N)	0.0	6.2E-005	0.0
Zinc	2,953.1	4.7E-002	138.8
Total	130,852		3,891

Table C-13

Pollutant Removals
Non-Integrated Steelmaking and Hot Forming Subcategory
Direct Dischargers - Stainless Segment

Chemical Name	Pounds Removed	Toxic Weighting Factor	Pound Equivalents (PE) Removed
	Option 1		Option 1
Aluminum	0.0	6.4E-002	0.0
Ammonia As Nitrogen (NH3-N)	0.0	1.8E-003	0.0
Antimony	52.1	4.8E-003	0.2
Boron	0.0	1.8E-001	0.0
Chromium	140.2	7.6E-002	10.7
Chromium, Hexavalent	0.0	5.1E-001	0.0
Copper	65.5	6.3E-001	41.2
Fluoride	0.0	3.5E-002	0.0
Iron	3,023.8	5.6E-003	16.9
Lead	0.0	2.2E+000	0.0
Manganese	277.0	7.0E-002	19.4
Molybdenum	0.0	2.0E-001	0.0
Nickel	637.3	1.1E-001	70.1
Nitrate/Nitrite (NO2 + NO3-N)	0.0	6.2E-005	0.0
Titanium	5.7	2.9E-002	0.2
Zinc	1,509.6	4.7E-002	71.0
Total	5,711		230

Table C-14

**Pollutant Removals
Cokemaking Subcategory
Indirect Dischargers**

Chemical Name	Pounds Removed		Toxic Weighting Factor	Pound Equivalents (PE) Removed	
	Option 1	Option 3		Option 1	Option 3
2,4-Dimethylphenol	1,211.8	2,592.6	5.3E-003	6.4	13.7
2-Methylnaphthalene	44.0	66.7	8.0E-002	3.5	5.3
2-Phenylnaphthalene	4.3	27.8	1.5E-001	0.6	4.2
Acetone	5.2	13.0	5.0E-006	0.0	0.0
Ammonia As Nitrogen (NH3-N)	194,504.6	294,160.3	1.8E-003	350.1	529.5
Aniline	123.5	612.7	1.4E+000	172.9	857.8
Benzene	0.6	1.1	1.8E-002	0.0	0.0
Benzo(a)anthracene	0.7	3.8	1.8E+002	129.1	679.6
Benzo(a)pyrene	4.3	9.5	4.3E+003	18,604.0	40,804.4
Benzo(b)fluoranthene	2.0	8.3	4.2E+002	844.4	3,483.9
Chrysene	1.4	6.3	2.1E+000	2.9	13.2
Dibenzofuran	0.5	1.7	2.0E-001	0.1	0.3
Fluoranthene	78.7	135.1	8.0E-001	62.9	108.1
Mercury	0.1	0.5	1.2E+002	16.1	63.5
n-Eicosane	11.2	44.4	4.3E-003	0.0	0.2
n-Octadecane	226.2	330.4	4.3E-003	1.0	1.4
Naphthalene	3.9	6.3	1.5E-002	0.1	0.1
Nitrate/Nitrite (NO2 + NO3-N)	28.1	67.2	6.2E-005	0.0	0.0
o-Cresol	2,420.5	17,297.8	2.7E-003	6.5	46.7
p-Cresol	40,947.2	59,836.1	4.0E-003	163.8	239.3
Phenanthrene	3.4	7.5	2.9E-001	1.0	2.2
Phenol	0.0	15,206.0	2.8E-002	0.0	425.8
Pyrene	15.2	29.0	1.1E-001	1.7	3.2
Pyridine	13.9	23.1	1.3E-003	0.0	0.0
Selenium	228.6	1,673.0	1.1E+000	251.5	1,840.3
Thiocyanate	20,880.0	191,559.9	1.2E-001	2,505.6	22,987.2
Total Cyanide	2,842.2	5,156.7	1.1E+000	3,126.5	5,672.4
Weak Acid Dissociable Cyanide	28.0	88.5	0.0E+000	0.0	0.0
Total	263,630	588,965		26,251	77,783

Table C-15

Pollutant Removals
Non-Integrated Steelmaking and Hot Forming Subcategory
Indirect Dischargers - Stainless Segment

Chemical Name	Pounds Removed	Toxic Weighting Factor	Pound Equivalents (PE) Removed
	Option 1		Option 1
Aluminum	0.0	6.4E-002	0.0
Ammonia As Nitrogen (NH ₃ -N)	0.0	1.8E-003	0.0
Antimony	18.1	4.8E-003	0.1
Boron	0.0	1.8E-001	0.0
Chromium	31.3	7.6E-002	2.4
Chromium, Hexavalent	0.0	5.1E-001	0.0
Copper	11.4	6.3E-001	7.2
Fluoride	0.0	3.5E-002	0.0
Iron	611.4	5.6E-003	3.4
Lead	0.0	2.2E+000	0.0
Manganese	190.0	7.0E-002	13.3
Molybdenum	0.0	2.0E-001	0.0
Nickel	332.9	1.1E-001	36.6
Nitrate/Nitrite (NO ₂ + NO ₃ -N)	0.0	6.2E-005	0.0
Titanium	0.5	2.9E-002	0.0
Zinc	319.2	4.7E-002	15.0
Total	1,515		78

Table C-16

**Baseline Pollutant Discharges
Cokemaking Subcategory
Direct Dischargers**

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
2,4-Dimethylphenol	154.0	5.3E-003	0.8
2-Methylnaphthalene	215.6	8.0E-002	17.2
2-Phenylnaphthalene	163.2	1.5E-001	24.5
Acetone	811.0	5.0E-006	0.0
Ammonia As Nitrogen (NH3-N)	452,520.0	1.8E-003	814.5
Aniline	163.9	1.4E+000	229.5
Benzene	78.6	1.8E-002	1.4
Benzo(a)anthracene	177.8	1.8E+002	32,002.2
Benzo(a)pyrene	164.1	4.3E+003	705,501.0
Benzo(b)fluoranthene	138.3	4.2E+002	58,102.8
Chrysene	176.3	2.1E+000	370.1
Dibenzofuran	162.5	2.0E-001	32.5
Fluoranthene	198.5	8.0E-001	158.8
Mercury	4.7	1.2E+002	565.8
n-Eicosane	162.5	4.3E-003	0.7
n-Octadecane	162.5	4.3E-003	0.7
Naphthalene	184.5	1.5E-002	2.8
Nitrate/Nitrite (NO2 + NO3-N)	1,738,200.0	6.2E-005	107.8
o-Cresol	180.0	2.7E-003	0.5
p-Cresol	159.6	4.0E-003	0.6
Phenanthrene	154.0	2.9E-001	44.7
Phenol	320.5	2.8E-002	9.0
Pyrene	189.8	1.1E-001	20.9
Pyridine	164.7	1.3E-003	0.2
Selenium	4,799.4	1.1E+000	5,279.3
Thiocyanate	311,713.0	1.2E-001	37,405.6
Total Cyanide	74,488.0	1.1E+000	81,936.8
Total	2,586,007		922,631

Table C-17

**Baseline Pollutant Discharges
Sintering Subcategory
Direct Dischargers**

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.0017	6.7E+005	1,135.7
1,2,3,4,7,8-Hexachlorodibenzofuran	0.0016	6.7E+006	10,610.1
1,2,3,6,7,8-Hexachlorodibenzofuran	0.0015	6.7E+006	10,328.7
1,2,3,7,8-Pentachlorodibenzofuran	0.0016	3.3E+006	5,199.2
2,3,4,6,7,8-Hexachlorodibenzofuran	0.0015	6.7E+006	9,977.6
2,3,4,7,8-Pentachlorodibenzofuran	0.0017	3.3E+007	56,268.3
2,3,7,8-Tetrachlorodibenzofuran	0.0006	6.7E+006	4,135.1
2,4-Dimethylphenol	288.7	5.3E-003	1.5
4-Nitrophenol	1,492.6	9.4E-003	14.0
Aluminum	16,806.0	6.4E-002	1,075.6
Amenable Cyanide	685.1	0.0E+000	0.0
Ammonia As Nitrogen (NH ₃ -N)	1,722,900.0	1.8E-003	3,101.2
Arsenic	135.0	3.5E+000	472.3
Boron	10,583.4	1.8E-001	1,905.0
Cadmium	184.5	2.6E+000	479.8
Chromium	427.6	7.6E-002	32.5
Copper	243.9	6.3E-001	153.7
Fluoranthene	285.1	8.0E-001	228.1
Fluoride	403,720.0	3.5E-002	14,130.2
Iron	74,255.0	5.6E-003	415.8
Lead	1,087.1	2.2E+000	2,391.6
Magnesium	775,370.0	8.7E-004	674.6
Manganese	9,730.4	7.0E-002	681.1
Mercury	6.3	1.2E+002	761.2
Molybdenum	1,076.2	2.0E-001	215.2
Nickel	448.5	1.1E-001	49.3
Nitrate/Nitrite (NO ₂ + NO ₃ -N)	206,722.0	6.2E-005	12.8
o-Cresol	284.9	2.7E-003	0.8
p-Cresol	285.6	4.0E-003	1.1
Phenanthrene	286.3	2.9E-001	83.0
Phenol	289.0	2.8E-002	8.1
Pyridine	645.6	1.3E-003	0.8
Selenium	212.9	1.1E+000	234.2
Thallium	1,794.5	1.0E+000	1,794.5
Thiocyanate	3,318.8	1.2E-001	398.3
Titanium	49.1	2.9E-002	1.4
Total Cyanide	1,938.1	1.1E+000	2,131.9
Zinc	18,309.0	4.7E-002	860.5
Total	3,253,861		129,965

Table C-18

**Baseline Pollutant Discharges
Integrated Steelmaking Subcategory
Direct Dischargers**

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
Aluminum	62,809	6.4E-002	4,019.8
Ammonia As Nitrogen (NH ₃ -N)	24,046	1.8E-003	43.3
Cadmium	249	2.6E+000	646.2
Chromium	813	7.6E-002	61.8
Copper	1,120	6.3E-001	705.6
Fluoride	2,713,069	3.5E-002	94,957.4
Iron	279,083	5.6E-003	1,562.9
Lead	3,643	2.2E+000	8,014.9
Magnesium	2,555,442	8.7E-004	2,223.2
Manganese	15,971	7.0E-002	1,118.0
Molybdenum	33,232	2.0E-001	6,646.3
Nitrate/Nitrite (NO ₂ + NO ₃ -N)	103,637	6.2E-005	6.4
Tin	523	3.0E-001	157.0
Titanium	571	2.9E-002	16.6
Vanadium	1,134	6.2E-001	703.2
Zinc	41,196	4.7E-002	1,936.2
Total	5,836,539		122,819

Table C-19

**Baseline Pollutant Discharges
Integrated and Standalone Hot Forming Subcategory
Direct Dischargers - Carbon Segment**

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
Ammonia As Nitrogen (NH ₃ -N)	699,670.1	1.8E-003	1,259.4
Fluoride	4,432,669.7	3.5E-002	155,143.4
Iron	7,331,536.9	5.6E-003	41,056.6
Lead	20,402.5	2.2E+000	44,885.5
Manganese	69,340.2	7.0E-002	4,853.8
Molybdenum	55,755.8	2.0E-001	11,151.2
Zinc	75,939.4	4.7E-002	3,569.2
Total	12,685,315		261,919

Table C-20

Baseline Pollutant Discharges
Non-Integrated Steelmaking and Hot Forming Subcategory
Direct Dischargers - Carbon Segment

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
Ammonia As Nitrogen (NH3-N)	37,662.9	1.8E-003	67.79
Boron	10,651.2	1.8E-001	1,917.21
Copper	11,078.4	6.3E-001	6,979.36
Fluoride	57,038.1	3.5E-002	1,996.33
Iron	361,864.5	5.6E-003	2,026.44
Lead	2,472.8	2.2E+000	5,440.26
Manganese	43,109.2	7.0E-002	3,017.64
Molybdenum	4,422.1	2.0E-001	884.42
Nitrate/Nitrite (NO2 + NO3-N)	27,847.5	6.2E-005	1.73
Zinc	11,389.6	4.7E-002	535.31
Total	567,536		22,867

Table C-21

Baseline Pollutant Discharges
Non-Integrated Steelmaking and Hot Forming Subcategory
Direct Dischargers - Stainless Segment

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
Aluminum	872.6	6.4E-002	55.8
Ammonia As Nitrogen (NH ₃ -N)	1,168.8	1.8E-003	2.1
Antimony	126.0	4.8E-003	0.6
Boron	1,800.8	1.8E-001	324.1
Chromium	295.8	7.6E-002	22.5
Chromium, Hexavalent	143.3	5.1E-001	73.1
Copper	129.5	6.3E-001	81.6
Fluoride	82,093.2	3.5E-002	2,873.3
Iron	6,129.1	5.6E-003	34.3
Lead	64.0	2.2E+000	140.7
Manganese	538.3	7.0E-002	37.7
Molybdenum	13,634.4	2.0E-001	2,726.9
Nickel	1,251.1	1.1E-001	137.6
Nitrate/Nitrite (NO ₂ + NO ₃ -N)	4,272.0	6.2E-005	0.3
Titanium	12.1	2.9E-002	0.4
Zinc	2,816.3	4.7E-002	132.4
Total	115,347		6,643

Table C-22

**Baseline Pollutant Discharges
Cokemaking Subcategory
Indirect Dischargers**

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
2,4-Dimethylphenol	2,603.5	5.3E-003	13.8
2-Methylnaphthalene	92.5	8.0E-002	7.4
2-Phenylnaphthalene	33.2	1.5E-001	5.0
Acetone	41.6	5.0E-006	0.0
Ammonia As Nitrogen (NH3-N)	300,644.6	1.8E-003	541.2
Aniline	615.5	1.4E+000	861.7
Benzene	2.0	1.8E-002	0.0
Benzo(a)anthracene	4.6	1.8E+002	823.9
Benzo(a)pyrene	11.3	4.3E+003	48,519.1
Benzo(b)fluoranthene	9.8	4.2E+002	4,135.7
Chrysene	7.5	2.1E+000	15.7
Dibenzofuran	2.4	2.0E-001	0.5
Fluoranthene	161.2	8.0E-001	129.0
Mercury	0.6	1.2E+002	74.2
n-Eicosane	47.1	4.3E-003	0.2
n-Octadecane	341.1	4.3E-003	1.5
Naphthalene	8.0	1.5E-002	0.1
Nitrate/Nitrite (NO2 + NO3-N)	15,610.5	6.2E-005	1.0
o-Cresol	17,311.4	2.7E-003	46.7
p-Cresol	59,841.4	4.0E-003	239.4
Phenanthrene	9.1	2.9E-001	2.7
Phenol	15,206.9	2.8E-002	425.8
Pyrene	35.9	1.1E-001	3.9
Pyridine	24.9	1.3E-003	0.0
Selenium	2,398.0	1.1E+000	2,637.8
Thiocyanate	192,758.4	1.2E-001	23,131.0
Total Cyanide	8,142.9	1.1E+000	8,957.2
Weak Acid Dissociable Cyanide	411.0	0.0E+000	0.0
Total	616,377		90,574

Table C-23

Baseline Pollutant Discharges
Non-Integrated Steelmaking and Hot Forming Subcategory
Indirect Dischargers - Stainless Segment

Chemical Name	Pounds of Pollutants Discharged at Baseline	Toxic Weighting Factor	Pound Equivalents (PE) Discharged at Baseline
Aluminum	43.6	6.4E-002	2.8
Ammonia As Nitrogen (NH3-N)	421.7	1.8E-003	0.8
Antimony	19.7	4.8E-003	0.1
Boron	748.8	1.8E-001	134.8
Chromium	32.9	7.6E-002	2.5
Chromium, Hexavalent	72.2	5.1E-001	36.8
Copper	12.0	6.3E-001	7.5
Fluoride	20,532.5	3.5E-002	718.6
Iron	658.2	5.6E-003	3.7
Lead	9.4	2.2E+000	20.8
Manganese	203.8	7.0E-002	14.3
Molybdenum	6,573.6	2.0E-001	1,314.7
Nickel	357.1	1.1E-001	39.3
Nitrate/Nitrite (NO2 + NO3-N)	288.3	6.2E-005	0.0
Titanium	0.5	2.9E-002	0.0
Zinc	334.5	4.7E-002	15.7
Total	30,309		2,312